

THE
Model Engineer
AND
Amateur Electrician

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INDEX TO VOL. II.

A.B.C. of Dynamo Design, 23, 83, 143, 201, 229.
 Accumulator Cell, Repairing, 125.
 Accumulators, 175.
 Accumulators, Charging by Bunsen Battery, 126.
 Accumulators, Grids for, 150.
 Additions to a Screw-Cutting Lathe, Two Useful, 131, 226.
 Air-Pump for Testing Models, How to Make an, 191.
 Aluminium, How to File, 5.
 Aluminium, Practical Hints on Casting and Working, 133.
 Amateurs' Supplies, 19, 39, 59, 79, 103, 127, 151, 176, 199, 223, 247, 267.
 Arc-Lamp Queries, 102.
 Are Electric Wires Dangerous? 37.
 Armature Winding, 175.
 "Atlas" Gas Engine, 10, 51, 245.
 "Audrey," Model 5-Rater Yacht, 209.
 Automatic Telephone Switch, 173.
 "Avery Lahmeyer" $\frac{1}{4}$ -h.p. Dynamo, 263.
 "A.W.M." Dynamo, An, 4.
 "A.W.M." Motor, 247.
 Batteries, Carbon-Consuming, 98.
 Batteries, Fitting Up Carbons for Bichromate, 85.
 Battery for $\frac{3}{4}$ -in. Spark Coil, 174.
 Battery to Charge Accumulators, Bunsen, 126.
 Battleships at Olympia, Model, 41.
 Beginners' Column, Our, 170, 193, 216, 242.
 Bell, How to Make an Electric, 218, 243.
 Bells, Electric, Ringing in Series, 250.
 "Black Prince" Loco, 127.
 Boiler, Brazing Copper, 246.
 Boiler for a Model Steam Pinnace, 93.
 Boiler for Launch Engine, 101.
 Boiler for Torpedo Boat, 265.
 Boiler, Loco Type, 58, 126.
 Boiler Plate, Flanging, 246.
 Boiler Queries, 18, 38.
 Boiler, Water Tube, 198.
 Boilers, Calculating Size of, 198.
 Boilers for Model Steamer, 93, 174.
 Boilers, Horizontal, 38, 100, 103, 198.
 Boilers, Liquid Fuel Burners for Model, 205, 251.
 Boilers, Loco, 38, 58, 101, 102, 151, 205.
 Boilers, Vertical, 101, 102, 151, 222, 245, 246.
 Book-Shelf, For the, 5, 25, 54, 103, 107, 132, 186, 219, 233, 253.
 Brass, Casting in, 125.
 Brass Foundry Work, 148, 173.
 Brazing, 232.
 Brazing Copper Boiler, 246.

Britain's Latest Battleship, H.M.S. "London," 231.
 Bunsen Battery to Charge Accumulators, 126.
 Burners for Model Boilers, Liquid Fuel, 205, 251.
 Calibrating Voltmeters, 17, 58.
 Carbon-Consuming Batteries, 98.
 Carbons for Bichromate Batteries, Fitting Up, 85.
 Cardboard Models of Locos, 249.
 Cargo Boat, "Magnetic," My Model Electric, 116, 174.
 Casting in Brass, 125.
 Casting Metal in the Amateur's Workshop, 237.
 Castings of Oil Engines, 150.
 Catalogues Received, 20, 40, 60, 80, 104, 128, 152, 176, 200, 224, 248, 267.
 Cells for Coil Working, 18, 174.
 Centring Work for the Lathe, 111, 197.
 Charging Accumulators, 126.
 Charging Dynamo, 245.
 Chucks for Loose Headstocks, 148.
 Coil and How to Make It, A Medical, 105.
 Coil for Wireless Telegraphy, 222.
 Coil, Medical, 100, 105.
 Coil, Spark, 102, 125, 198.
 Coil Winder, A Simple, 76.
 Coil, x-Ray, 102.
 Collectors for Wimshurst Machines, 32, 150.
 Colouring Electric Lamps, 148.
 "Columbia" and "Shamrock," 165.
 Condenser for Launch Engine, 246.
 Condenser for Model Engine, 175.
 Construction of Paper Model Yachts, The, 188.
 Contact Breaker, 100.
 Correspondence (Model Yachting), 96, 119, 139, 166, 190, 209, 238, 259.
 Crank Shaft, Simple Way to Make a Web, 173.
 Cruiser, A Model, 153.
 "Curaçoa's" Model Yacht Club, H.M.S., 187.
 Cylinders, Design for Model Locomotive, 68.
 Cylinders for Model Loco, 78.
 Demagnetising a Watch, 102.
 Demagnetisation of Watches, 265.
 Design for a Model Cutter Yacht, 114.
 Design for 100-Watt Dynamo, 168.
 Design for Model Locomotive Cylinders, 68.
 Desk Telephone, How to Make a, 61.
 Doings of the (Model Yachting) Clubs, 89, 113, 137.
 Drilling Frame, A Small, 123.
 Driving Work between Lathe Centres, 211.
 Dynamo and Engine Coupled Direct, 222.
 Dynamo, "Avery Lahmeyer" $\frac{1}{4}$ -h.p., 263.
 Dynamo, "A.W.M.," 4.

- Dynamo Charging, 245.
 Dynamo Design, A.B.C. of, 23, 83, 143, 201, 229.
 Dynamo, Design for a 100-Watt, 168.
 Dynamo, Estimating Output of, 58.
 Dynamo, Plating, Required to Use for Lighting, 77.
 Dynamo, Simplex, 77.
 Dynamo to Light Five 16-c.-p. Lamps, 78.
 Dynamos, Faulty, 58, 59, 125.
 Dynamos, Manchester Type, 58, 150.
 Dynamos, Overtypes, 58, 78, 150, 198, 245.
 Dynamos, Windings for, 125, 126, 150, 198.
- Edinburgh and Leith Model Yacht Club, 141.
 Editor's Page, 16, 35, 55, 74, 97, 122, 145, 172, 195, 220, 240, 264.
 Electrical Education, 17.
 Electrical Engineering, 245.
 Electrical Experiments Without Apparatus, 171.
 Electric Bell, How to Make an, 218, 243.
 Electric Bells, Ringing in Series, 250.
 Electric Car Motor, A Small, 182.
 Electric Cargo Boat, "Magnetic," Model, 116, 174.
 Electric Clock Alarms, 17, 36, 56, 76, 99, 149, 196.
 Electric Ignition for Oil Engine, 222.
 Electric Lamps, How to Colour, 148.
 Electric Lamps, Old, 197.
 Electric Launch, 37.
 Electric Light, Small, 77.
 Electric Motor-Car, Model, 129, 156, 197.
 Electric Motor for Boat, 174.
 Electric Motors, Simple, 123, 194.
 Electric Tramcar Motor, A Model, 42, 66, 198.
 Electric Tramcar, My Model, 225.
 Electro-Motor, Reverser for, 175.
 Electrotyping for Amateurs, 50, 88.
 Engine and Boiler for 1 h.-p. Motor Car, 79.
 Engine and Dynamo Coupled Direct, 222.
 Engine, Horizontal, 245.
 Engine to Drive 20-c.p. Dynamo, 150.
 Engines, Steam, Gas, Oil, and Hot Air, 78.
 Engraving on Steel, Cheap Method of, 5.
- Fast Model Torpedo Boat Destroyer, A, 44.
 File Aluminium, How to, 5.
 Firebox, Setting out Plate for Taper, 79.
 Flanging Boiler Plate, 246.
 Flat Filing, 244.
 Fluorescent Screens for x-Ray Work, How to Make, 5.
 Flywheels, The Bursting of Small Cast-Iron, 34.
 Force Pump, 38, 58.
 Forgings for Model Engines, 124.
- Galvanometer, How to Make a, 86.
 Gas Engine for Automobile, 175.
 Gas Engine, How to Make a Small, 10, 51, 245.
 G.N.R. Express, Model Loco, 103, 124.
 Gramophone, 198.
 Grids for Accumulators, 150.
 Guernsey Model Yacht Club, 115.
- Hammer, A Model Steam, and How to Make It, 108, 206.
 Heating Apparatus for an Amateur's Workshop, 204.
 Hints on Soft Soldering, 22.
 Hints on Working and Casting Aluminium, 133.
 Hooke's Joint, A Simple Model of, 67.
 Horizontal Boilers, 38, 100, 103, 198.
 Horizontal Engine, 245.
 Horse Power, 245.
 How a Battery Works, 251.
 How to Build a Model 10-rater Cutter Yacht, 90.
 How to Centre Work for the Lathe, 111, 197.
- How to Make an Electric Bell, 218, 243.
 How to Make a Cheap and Simple Lathe, 216, 242.
 How to Make a Cheap Reliable Galvanometer, 86.
 How to Make a Desk Telephone, 61.
 How to Make a Double-Acting Air Pump for Testing Models, 191.
 How to Make a 5-in. Screw-Cutting Lathe, 13, 69.
 How to Make a Hand-Planing Machine, 146, 183.
 How to Make a Medical Coil, 105.
 How to Make a Model Steam-Hammer, 108, 206.
 How to Make a Small Gas-Engine, 10, 51, 245.
 How to Make a Telephone Station, 1.
 How to Make Fluorescent Screens for x-Ray Work, 5.
 How to Solder Successfully, 160.
 How to Start a Workshop, 170, 193.
 Hydraulic Piston, 175.
- Incandescing Platinum Wire, 245.
 Induction Coils, 102, 126, 198.
 Ignition for Oil Engine, Electric, 222.
 Injector, A Small, 173.
 Institution of Junior Engineers, 51, 77, 203.
 Inverleith Pond, The, 165.
- Jottings, 38, 52, 163, 186.
- Lacquering Model Engine, 222.
 "Lady of the Lake" Model Yacht, 118.
 Lathe, How to Centre Work for the, 111, 197.
 Lathe, How to Make a Cheap and Simple, 216, 242.
 Lathe, How to Make a 5-in. Screw-Cutting, 13, 69.
 Lathe, Two Useful Additions to a Screw-Cutting, 131, 226.
 Launch Engine, 38.
 Launch Engine, Boiler for, 101.
 Link Motion, 126.
 Link-Reversing Gear for Launch Engine, 151.
 Liquid Fuel Burners for Model Boilers, 205, 251.
 List of Model Yacht Clubs, 142, 239.
 Loco, A Powerful Model, 21.
 Loco, "Black Prince," 127.
 Loco Boilers, Model, 38.
 Loco, Cylinders for Model, 68, 78.
 Loco, G.N.R. Express, 103, 124.
 Loco, L. & N.W.R. Express, 101.
 Loco, "Lord of the Isles," 126.
 Loco, Midland Passenger, 78, 81, 150.
 Loco, Model, 37, 151.
 Locos, Cardboard Models of, 249.
 Locos, "Jeanie Deans" and "Greater Britain," 18.
 "London," Britain's Latest Battleship, H.M.S., 231.
 Loud-Speaking Telephone, 245.
- "Magnetic," Model Electric Cargo Boat, 116, 174.
 Magnets, Permanent, 125.
 "Majestic," Model Paddle Steamer, 177.
 Making Small Tools for Model Work, 28, 49, 57, 76, 123.
 Measurement Rules, Model Yacht, 164.
 Medical Coil, 100, 105.
 Melting Metals in the Amateur's Workshop, 237.
 Midland Passenger Loco, 78, 81, 150.
 Model Battleships at Olympia, 41.
 Model Cruiser, A, 153.
 Model Electric Cargo Boat, "Magnetic," 116, 174.
 Model Electric Motor-Cars, 129, 156, 197.
 Model Electric Tramcar Motor, A, 42, 66, 198.
 Model Electric Tramcar, My, 225.
 Model Engineers and Their Work, 6, 26, 47, 64.
 Model 5-Rater Yacht, "Audrey," 209.
 Model Loco Running, 17.
 Model Paddle Steamer, "Majestic," My, 177.

- Model Railways, 162, 181, 212, 234, 255.
 Model Steam Hammer and How to Make It, A, 108, 206.
 Model 10-Rater Cutter Yacht, How to Build a, 90.
 Model Torpedo Boat, 38.
 Model Torpedo Boat Destroyer, A Fast, 44.
 Model Yacht Measurement Rules, 164.
 Model Yachting at Lowestoft, 189.
 Model Yachting Notes, 208, 238, 259.
 Models I have Made, Some, 134.
 Models of Locos in Cardboard, 249.
 Motor, A Small Electric Car, 182.
 Motor, "A.W.M.," 247.
 Motor Car, Engine and Boiler for 1-h.-p., 79.
 Motor Car Exhibition, The, 155.
 Motor Car, Gas Engine for, 175.
 Motor Cars, Model Electric, 129, 156, 197.
 Motor for Boat, 174.
 Motor for Model Electric Tramcar, 42, 66, 198.
 Motor for River Gig, 59.
 Motor, How to Make a Very Simple Electro-, 194.
 Motor Tramcar, 246.
 Oil Engine, A New, 192.
 Oil Engine, Castings of, 150.
 Old Electric Lamps, 197.
 Oscillating Cylinders for Model Loco, 78.
 Oscillating Cylinders, Reversing Gear for, 57, 58, 77.
 Our Beginners' Column, 170, 193, 216, 242.
 Output of Dynamo, Estimating, 58.
 Paddle Steamer "Majestic," My Model, 177.
 Paper Model Yachts, The Construction of, 188.
 Parting Tool, A Useful, 112.
 Patent Office Library, The, 57.
 Permanent Magnets, 125.
 Petroleum Blast Lamp, 246.
 Piston, Hydraulic, 175.
 Piston Valves, 18.
 Planing Machine, How to Make a Hand, 146, 183.
 Plating Dynamo Required to Use for Lighting, 77.
 Pole Testing Paper, 5.
 Ports for Steam Engines, 78, 246.
 Powerful Model Loco, A, 21.
 Practical Letters from our Readers, 17, 36, 56, 76, 99, 123, 148, 173, 196, 221, 243, 265.
 Preserving Tools from Rust, 196.
 Prize Competitions, 16, 35, 56, 75, 96, 97, 118, 121, 122, 138.
 Queries and Replies, 17, 37, 58, 77, 100, 124, 150, 174, 198, 222, 244, 266.
 Racing Fixtures (Model Yacht) 95.
 Racing Reports (Model Yacht) 94, 121, 142, 167, 191.
 Radial Valve Gear, 198.
 Repairing Accumulator Cell, 125.
 Resistance, Water, 77.
 Reverser for Electro-Motor, 175.
 Reversing Gear for Launch Engine, Link, 151.
 Reversing Gear for Oscillating Cylinders, 57, 58, 77.
 Ringing Electric Bells in Series, 250.
 Rust, Preserving Tools from, 196.
 Screw-Cutting Lathe, How to Make a 5-in. 13, 69.
 Screw-Cutting Lathe, Two Useful Additions to a, 131, 226.
 Scribing Block, A Useful, 76.
 Setting-out Plate for Taper Firebox, 79.
 "Shamrock" and "Columbia," 165.
 Simple Electric Motor, 123.
 Simple Water Motor, 37, 57, 197.
 Simplex Dynamo, 77.
 Slide Valve, The, 29.
 Society of Model Engineers, 9, 33, 53, 73, 98, 107, 127, 135, 159, 186, 214, 241, 261.
 Soldering Aluminium, 99.
 Soldering, Hints on Soft, 22.
 Soldering Zinc, 58, 77, 100.
 Solder Successfully, How to, 160.
 Spanner, An Idea for, 17.
 Spark Coil, 102, 125, 198.
 Speedometer, A Cheap, 265.
 Spiral Springs, Making, 99.
 Start a Workshop, How to, 170, 193.
 Steam and Exhaust Ports, 78, 246.
 Steam, Gas, Oil, and Hot-Air Engines, 78.
 Steam Hammer, and How to Make It, A Model, 108, 206.
 Steam Raising in Model Locomotives, 243.
 Steering Gear for Model Sailing Yachts, 140, 190.
 Switch, Automatic, 100.
 Telephone, How to Make a Desk, 61.
 Telephone, Loud-Speaking, 245.
 Telephone Station, How to Make a, 1.
 Telephone Switch, Automatic, 173.
 Tempering Small Tools, 123.
 Tenby Model Yacht Club, 92.
 Ten-Rater Cutter Yacht, How to Build a Model, 90.
 Text-Book on Model Locos, 174.
 Tools for Model Work, Making Small, 28, 49, 57, 76, 123.
 Torpedo Boat Destroyer, A Fast Model, 44.
 Torpedo Boat, Model, 38, 245, 265.
 Tramcar Motor, Model Electric, 42, 66, 198, 246.
 Tramcar, My Model Electric, 225.
 Truck, A Model Railway, 110.
 Tube Expander, A Simple, 244.
 "Turbina," The, 126.
 Two Useful Additions to a Screw-cutting Lathe, 131, 226.
 Vertical Boiler, 101, 102, 151, 222, 245, 246.
 Voltage of Induction Coil, 102, 126.
 Voltmeters, Calibrating, 17, 58.
 Watches, Demagnetisation of, 265.
 Water Motor, A Simple, 37, 57, 197.
 Water Resistance, 77.
 Water Tube Boiler, 198.
 Wehnelt Electrolytic Interruptor for x-Ray Work, The, 236.
 Wimshurst Machine, 150, 246.
 Wimshurst Machine, Collectors for, 32, 150.
 Winding Armatures, 175.
 Winding Small Dynamos, 125, 126, 150, 198.
 Windmill to Drive Dynamo, 222.
 Wind-Motors, Small, 221.
 Wireless Telegraphy, 124, 174, 244.
 Wireless Telegraphy, Coil for, 222.
 Wirral Model Yacht Club, 120.
 Workshop, How to Start a, 170, 193.
 Workshop Wrinkles and Recipes, 5, 155.
 X-Ray Coil, 102.
 X-Ray Experiments for Amateurs, 180, 212.
 Yacht "Audrey," Model 5-Rater, 209.
 Yacht Building, Model, 18, 188.
 Yacht, Design for a Model Cutter, 114.
 Yacht, How to Build a Model 10-Rater Cutter, 90.
 Yachting Readers, To our Model, 89.
 Yachts, The Construction of Paper Model, 188.

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No. 13.

How to Make a Telephone Station.

By COLVILLE BARRINGTON.

(Continued from page 221, Vol. I.)

THE two-way ringing key must now be made. For this we want a piece of wood $3\frac{3}{8}$ in. long and $\frac{3}{8}$ in. square, with a gap cut out at one end as in the two arms. A hole is drilled at this end for a screw which lever fastens it to the base. A narrow hole is cut in this strip of wood like one seen in a plane, through which hole a narrow strip of brass runs nearly as far as the screw hole. This piece of spring brass bears down upon a piece screwed on to the base as the other ones do, and at its other end is soldered to a piece of brass about $1\frac{1}{2}$ in. long, which is bound over the wooden strip in the form

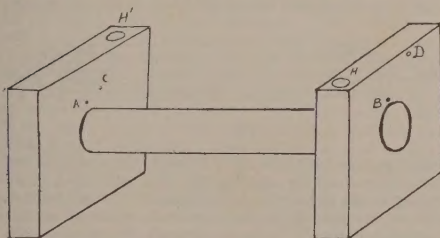


FIG. 4.

of a saddle, and secured with a screw at each end at the top—none at the sides. (Reference to C, Fig. 3, will make all plain.) We now want a small strip of this wood, $\frac{3}{8}$ in. square and 2 ins. long, in which a recess is to be cut $\frac{3}{8}$ in. from one end, and deep enough so that when screwed on to the long piece (Fig. 3, C) it will work in and out of the lower hole in the side of the instrument when the lever is screwed to the base. Here we need a piece of clock spring (one from an old American clock does well). At one end of these springs there is usually a loop; break off the spring $3\frac{1}{2}$ ins. from this loop, and bend it gently (by heating) into the shape shown at S, Fig. 2; then heat it and chill it suddenly to restore its

springiness. We can screw the spring to the base with a screw through the loop (putting a piece of brass under the loop as shown in C B, Fig. 2, that the spring may be free from scraping the base). Now push the spring upwards, bearing against the underneath of the long lever arm until, when you pull the lever arm and then release it, it goes up with a sharp "click" by the action of the spring. Put a screw in underneath the spring as marked at T in Fig. 2.

Another piece of spring—preferably doubled—must be fixed on the base, as in Fig. 2 D, pressing fairly tightly against the far end of the ringing key lever.

When all these things have been fastened on to the base, as depicted in Fig. 2, the sides may be screwed on. The ringing key should now work freely and the lever arm go up and down quite easily, so that when it is up the brass on the top of it presses against the brass piece

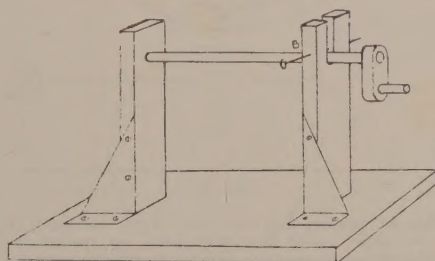


FIG. 5.

marked A Fig. 2, and when it is down A becomes disconnected from the brass piece on the long lever arm, and the brass piece B is then in contact with the strip on the lower lever arm. These two strips must never touch the two lever arms at the same time. The same is to be said of the ringing key's strips, for which key we have now to screw on a brass piece to the side of the instrument, so that when the key is at rest it presses up against the side by the action of the piece of clockspring. The side of the brass saddle piece is now in metallic contact with the brass strip which is screwed to the side. When the key is depressed, this lever must become quite detached from this side strip while it touches the other one (Fig. 2, Y).

We shall now proceed to make the induction coil, which makes the speech very much clearer and also enables us to reproduce conversations, &c., at much greater distances than we could do without it. For this we need two pieces of hardwood, each $1\frac{1}{2}$ ins. square and $\frac{1}{2}$ in. thick, through the centres of which drill a hole $\frac{1}{4}$ in. in diameter and two holes as at H, H', Fig. 4. With glue and brown paper make a tube 3 ins. long and $\frac{3}{8}$ in. external diameter, having two thicknesses of paper, and when quite set slip it through these holes in the wooden ends and glue in firmly. We shall thus get a good rigid bobbin. In each end of the bobbin, before the tube is put in, bore two little holes as shown in Fig. 4. A, B, C, D. A is where one end of the primary projects, and B where the other end comes out. There are five layers of this primary wire, for which No. 24 B.W.G. copper silk-covered wire is to be used; 3 ozs. will be sufficient.

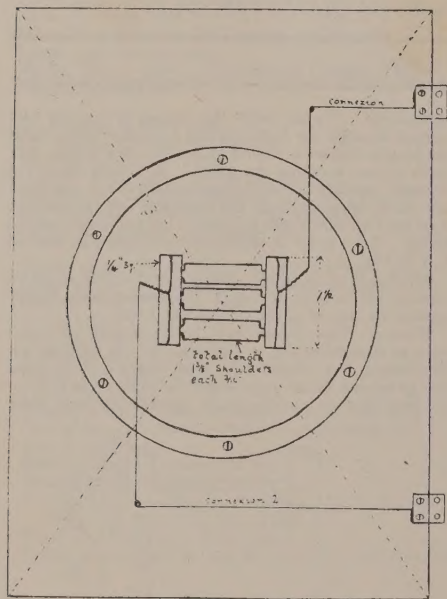


FIG. 6.

After the primary has been laid on put two turns of brown paper round it, closely fitting up against the bobbin ends, and over this pour hot paraffin wax, or else varnish it with shellac varnish, so as to completely insulate it from the secondary winding. This is absolutely necessary. When all is quite dry the secondary must be wound on, not before. It does not matter in which direction we wind either primary or secondary, only it is advisable to have thicker wires going out of the bobbin ends at each end of the secondary. This is best done by having two or three turns of thicker wire—say No. 24—round the bobbin to begin with, and then the end of the secondary wire, which is very fine, may be soldered to this wire. Always solder joints, and give them a turn of paraffin waxed paper all along the part where the wires are bared.

The secondary winding will require from $3\frac{1}{2}$ ozs. to 4 ozs. B.W.G. No. 36 silk-covered copper wire. The

object in having a thicker wire soldered to each end of the secondary is because No. 36 is so very fine and so easily broken, and rather difficult to deal with in making connections outside. Care must be taken to mark the ends of the primaries or the ends of the secondaries so that no mistake shall be made in connecting one end of a primary and one end of a secondary, in which case the coil would not work. It is very necessary to be quite sure of the ends of your windings in this coil, for if connected up incorrectly later on you will be disappointed. In Fig. 5 there is shown an arrangement which will make the wind-

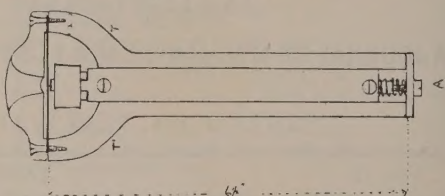


FIG. 7.

ing of this induction coil a very simple matter. Take a piece of wood for the base, any common wood, 12 ins. long, 6 ins. wide, and 1 in. thick, and two strips of wood each 6 ins. long, 2 ins. wide, and 1 in. thick. Drill a hole in one $\frac{1}{4}$ in. diameter and 1 in. from the top, and a hole in the other in the same position only not quite through. Fix these uprights on the base 6 ins. apart from each other, as shown in Fig. 5. Two long French nails will hold them securely with a little glue. They may be made very rigid with pieces of tin or brass screwed to them and to the base, as shown.

Now get a round piece of wood $8\frac{1}{2}$ ins. long and $\frac{1}{4}$ in. diameter; this is for the spindle and must not be too tight a fit into the holes in the uprights. In the right-hand upright cut out a piece of wood from the top to the hole $\frac{1}{4}$ in. wide, so that the spindle may be first put through the bobbin to be wound (which can be fixed firmly on it by a turn or two of paper if a loose fit), and then its end put into the hole in the left-hand upright

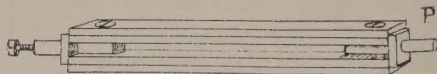


FIG. 8

(which hole is not bored right through the upright), and then the end of the spindle can be simply laid in its bearing in the right-hand upright and a thickish piece of wire put through above the spindle to make all secure. A small hole should be bored through the spindle close up to the inside of B (Fig. 5), and a piece of wire put in and allowed to project a little, or a wooden collar can be slipped on and fastened with a small screw to the spindle. This serves to keep the spindle in its proper position. A handle is to be made from a piece of hardwood 1 in. wide, 3 ins. long, $\frac{1}{4}$ in. thick, with ends rounded off and a $\frac{1}{4}$ in. hole drilled through $\frac{1}{2}$ in. from each end as in Fig. 5, and a piece of $\frac{1}{4}$ in. rod used for the handle. A little glue will make all secure. In winding the coil do not go quite up to the wooden ends with the turns of wire; leave room, say, for three turns, and you will thus make the insulation better between each layer in both primary and secondary.

Between all layers of wire put a sheet of good thin paraffin waxed paper, making a good, smooth, tight fit

all round, so be careful that your wooden ends are fitted truly when making the bobbin. To make the waxed paper, melt some paraffin wax or good candles in a flat tin in the oven, and in this dip well dried paper (not glazed paper) and drain off the superfluous wax well before a hot fire. When the coil is finished, as regards the winding, slip out the spindle and fill the centre with very soft iron wires 3 ins. long. These wires should be about as thick as a stout pin and very soft to get the best results (No. 18 or 20 is best.) The transmitter is a very important part and by far the most difficult to get to work satisfactorily. If the reader finds this a stopper to the success of the instrument, Messrs. Whitney & Co., of 117, City Road, E.C., supply very good transmitters for about

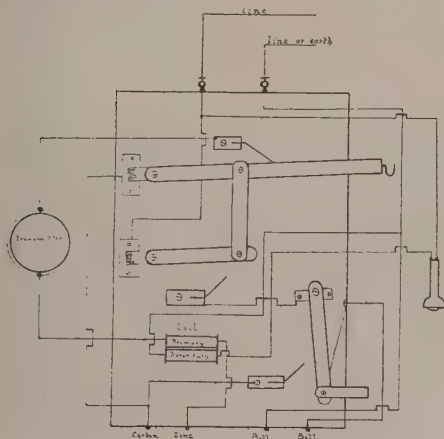


FIG. 9.

3s. 6d. each for attachment, where also the iron and copper wires may with advantage be bought, as one may then be sure of having good material. The writer has made a very successful transmitter from three small bits of electric lighting carbons, about as thick as a pencil, $1\frac{1}{2}$ ins. long, with shoulders filed at each end $3\cdot16$ ths in. long. These tapered ends then fit quite loosely into suitable holes in two little blocks of carbon $\frac{3}{4}$ in. square and $1\frac{1}{2}$ ins. long. Each block is held firmly in position on the diaphragm by having a length of clean, bare copper wire (No. 18) inserted from the front of the diaphragm and twisted round the block lengthways at the back, as is shown in Fig. vi. A little groove is filed at end of each block, so as to lessen chance of breaking wire.

The door of the telephone station which carries the transmitter is made from $1\frac{1}{2}$ in. wood, $5\frac{1}{2}$ ins. by 8 ins. Be careful that all the corners are true; then draw diagonals (see Fig. 6), and the point where they cross take as centre for a circle $1\frac{1}{2}$ ins. radius. A good diaphragm may be made from cardboard $1\cdot16$ th in. thick and 4 ins. diameter. This is put on inside the door, and can be held in place by the frame work from an old American clock with six holes drilled in it for screwing firmly to the door. Failing this piece of clock frame take a piece of hardwood $4\frac{1}{2}$ ins. square, and by diagonals find centre for a circle of 3 ins. diameter, as in the door, which fret out. Then secure diaphragm tightly between this and the door with screws. The method of attaching the carbon parts to the diaphragm is shown in Fig. 6. Put on hinges $1\frac{1}{2}$ ins. from each end, as shown, and solder a

wire to the wire holding one carbon block, and to one of the hinges and another wire from the other hinge to the other wire holding the other carbon block. Any ornamental design may be screwed on to the front of the door for good appearance. The hole should be 2 ins. diameter in this, and a variety of patterns may be made by doubling a sheet of paper first one way and then the other way, and cutting with scissors along two sides.

The receiver is, perhaps, the most interesting part of the whole apparatus. For this is needed a wooden case of the sizes and shape shown in Fig. 7. A compound bar magnet will be essential for good working, and this must be bought. Messrs. Mendham & Co., of Western Electrical Works, Bristol, supply just the thing at 2s. 9d. each, of the form and size shown in Fig. 8. At end A of receiver screw on a circular piece of ebonite with hole in the centre large enough to allow the screw in the end of magnet to pass through. A piece of strong spiral spring is put over the end piece of magnet, and presses magnet

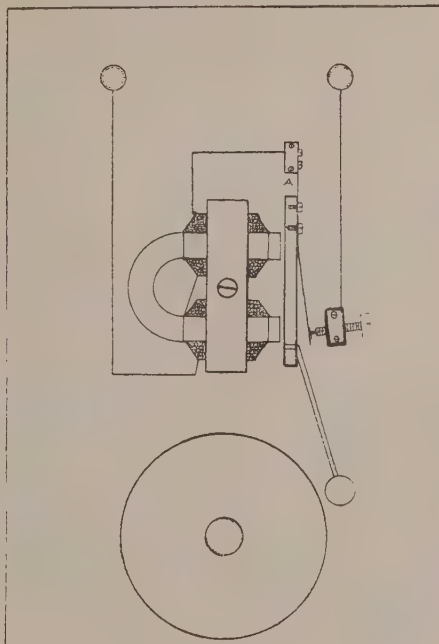


FIG. 10.

up towards the diaphragm, while the screw keeps it from going too far; thus a nice adjustment is possible. The hole in the middle of the case must be sufficiently large to allow the magnet to be fairly easily shifted up and down. Do not be persuaded to use a plain steel magnet instead of a compound one, as the feeble and intensely rapidly altering currents, which cause the reproduction of speech, etc., in the receiver, give infinitely better results with a magnet of the compound form as here described, and the results would be even better if we used a two-pole polarised magnet, so that we should then have two bobbins instead of one in each receiver and the magnetic circuit would be greatly improved. A little bobbin is made to

fit over the soft iron pole piece P, 1 in. diameter, $\frac{3}{8}$ in. deep, and this is wound carefully full of No. 36 silk-covered copper wire. The two ends are best soldered to thicker wires, which can be attached to terminals either at the end as shown, or at TT'. The wires can be lead down a deep slit in the outer case to the terminals at the end.

For the diaphragm a piece of ferrotype plate (which photographers use) or thin tinned iron, $2\frac{1}{2}$ ins. diameter, free from all buckles, is to be used, and the cover screwed carefully and firmly on with eight thin screws. The distance of the magnet pole piece from the diaphragm should be a space about the thickness of a post card. The best adjustment for each particular receiver with its transmitter is determined by experiment.

Everything is now ready for connecting up, and reference to Fig. 10 will clearly show the various connections.

The best battery to use with this instrument is the Leclanché No. 2. Two cells in series at each station if the distance is not great.

To make the bell, take a piece of soft iron rod $4\frac{1}{2}$ ins. long and $\frac{3}{8}$ in. diameter and bend into U shape, as shown in Fig. 10. This must be softened as much as possible by burying in a red hot fire and leaving alone until the fire has gone out and the iron thus cooled very gradually. The inside distance between the two ends should be $\frac{3}{4}$ ins. On each limb glue a turn of brown paper to insulate the winding from the iron and wind on seven layers of No. 24 B.W.G. silk-covered copper wire on both extremities, as shown. After having wound one pole, be sure to reverse the direction of your winding for the other pole, or you will not get a proper electro-magnet.

The armature should be of soft iron—preferably a flat piece $\frac{1}{8}$ in. thick, $\frac{3}{8}$ in. wide, $1\frac{1}{2}$ ins. long—three small holes are drilled in this, as shown, one at one end and two at the other, all in a line. A piece of springy brass, 2 ins. long and $\frac{3}{8}$ in. wide is screwed or rivetted to the armature as in Fig. 10, leaving $\frac{1}{2}$ in. free, as at A, for attachment to a metal or wooden block. The other end of the spring is bent somewhat back, and must have a small piece of thickish platinum foil soldered to its end. A screw, pointed with a bit of platinum wire, is fixed in a wooden or metal block, and the platinum point on this screw must touch the platinum foil on the armature spring. When the bell is finished, as shown in Fig. 10, the armature spring should press lightly against the screw point, so as to ensure good contact. The hammer is a small brass knob on the end of a 2-in. brass or iron wire, which is soldered into the end hole in the armature. The magnet is securely fastened to the base by a cross piece of wood and a screw passing between the windings, care being taken not to harm the covering of the wires with the sharp threads of the screw. The various connections are shown in Fig. 10.

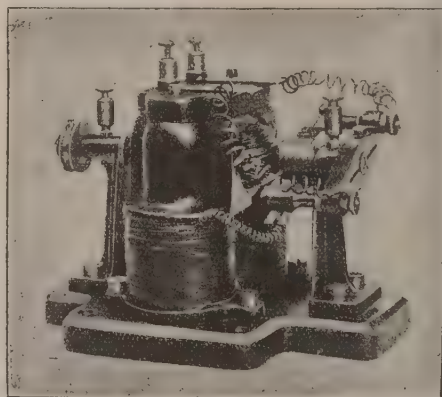
For the line wires, and for forming up the various parts in the instruments, it will be best to use No. 20, cotton-covered, india-rubbered, and paraffined bell wire. Of course, if the wires lead anywhere where exposed to dampness or the weather other wires must be chosen for those parts of the circuit in order to prevent leakages.

All to be done now, after having carefully finished the two stations and connected up the batteries and line wires, is to press the key at station 1, when bell at station 2 will ring. Then station 2 will ring back as soon as his bell stops ringing to acknowledge receipt of the call, and then both of you take your receivers off the hooks, when the lever arms will fly up and disconnect the bells and throw the transmitters, coils, and receivers into circuit, which were before cut out of circuit when the bells were in circuit. Always be sure to hang up receivers after speaking, otherwise you cannot call or be called by the

other station; and, in conclusion, the writer sincerely hopes that when station 1 asks station 2 "Are you there?" that station 2 may reply, "I am, and allow me to congratulate you on your uninterrupted telephonic system."

An "A.W.M." Dynamo.

IT will probably be remembered that in our issue of February last, we published an article by our contributor, "A.W.M.," showing original drawings for a small dynamo designed to give an output of 8 volts 1 ampère. Since then Mr. M. Don, of Goudhurst, Kent, who undertook to supply castings from those drawings, has built a finished dynamo, and has forwarded it for our inspection and trial. The machine as made by Mr. Don is shown in the accompanying photograph, and we append the report of "A.W.M.," who carried out the trial of the



MODEL DYNAMO, DESIGNED BY "A.W.M."

dynamo at our request. He says:—"I have tested the small dynamo with the following results: At a speed of 3,600 revolutions per minute, approximately, the output was 8 volts 1 ampère easily; at a speed of 3,500 revolutions per minute, approximately, 9 volts $2\frac{1}{2}$ amperes; and at 2000 revolutions per minute, approximately, 12 volts $1\frac{1}{2}$ amperes. The proper speed and output for the machine is about 1,600 revolutions per minute, giving 8 volts and 1 to $1\frac{1}{2}$ amperes, but as can be seen, this dynamo will give a greater output for occasional purposes. The low speed is partly due to the very small clearance between the armature and pole pieces. This amount in the machine submitted is scarcely sufficient to allow the armature running without risk of touching, and I think it would be a good plan to slightly increase and run a higher speed. The machine ran without any sparking at the brushes in all the above tests."

Readers who wish to preserve their copies of THE MODEL ENGINEER in good condition for binding at the end of the year are strongly advised to procure one of the cloth reading cases which we supply. Each case holds twelve copies, and can be had from our office for 1s., or post free 1s. 3d.

For the Book-shelf.

[Any book reviewed under this heading can be obtained from THE MODEL ENGINEER BOOK DEPARTMENT, 6, FARRINGTON AVENUE, LONDON, E.C., by remitting the published price and cost of postage.]

FOWLER'S "MECHANICAL ENGINEER" POCKET-BOOK.
 Edited by Wm. FOWLER, Wh. Sc., A.M.I.C.E.,
 M.I.M.E. Manchester: The Scientific Publishing
 Company, Hodson's Court, Corporation Street.
 Price, 1s. 6d. Postage, 2d.

Although there are already a number of pocket-books published in the interests of those engaged in engineering work, we feel sure that the latest-come into this field, entitled as above, will meet with a very hearty welcome, partly by reason of the excellent judgment displayed in the selection and arrangement of the contents, and partly because the matter so presented is fully up-to-date. Further than this, we know of no other engineering hand-book which gives so much practical and really useful information at so moderate a price. There are over 300 pages of rules, tables, formulae, and descriptive matter dealing with mensuration, workshop matters, steam boilers, injectors, steam engines, locomotives, gas and oil engines, power transmission, hydraulics, electricity, chemistry, fuels, metallurgy, mining, building, ventilating, heating, and patents. These various sections of the book are very fully indexed, this fact greatly increasing the utility of the information. There is also a diary and calendar, and several pages ruled in squares for the recording of curves and diagrams. As but one instance of the up-to-date character of this book, we note that the section on gas and oil engines includes references to the uses of acetylene for motive power, the legal flash-point of petroleum, and the new Diesel oil engine. The book is of a convenient size for the pocket, and is strongly but neatly bound.

THE INDIAN AND EASTERN ENGINEER DIARY FOR 1899. London: 50, Fenchurch Street, E.C.

As indicated by the title, this is a diary compiled specially for engineers engaged in India and the East, or for those whose trading interests are located in this portion of the globe. In addition to a considerable amount of general commercial and technical information of much value for reference, there are special sections dealing with Indian and Eastern railways, weights and measures, transport facilities, money matters, &c., which engineers abroad should find of considerable service. The book is strongly bound in red cloth, and contains ample space for the various memoranda which one usually records in a diary.

How to Make Fluorescent Screens for X-Ray Work.

A CONTRIBUTOR to the *British and Colonial Druggist* says, from personal experience, that effective fluorescent screens may be made by the amateur, and that a material reduction in cost is thereby effected. Calcium tungstate he regards as a very fair material, and a salt of uranium he thinks very good (the particular salt not being mentioned). The method of making the screen is as follows:—Take a plate of glass, say $8\frac{1}{2}$ ins. by $6\frac{1}{2}$ ins.; make a mask of stout paper with an opening 7 ins. by 5 ins.; wet this mask with glycerine or mucilage of gum arabic and place it over the plate; cover the plate with collodion, or varnish, or mucilage (with a little glycerine added), and sift the powdered salt quickly and evenly all over the surface. If vellum, parchment, cardboard, or ebonite be used as the

support, one may put a coating on both sides, and thus even up any inequalities of deposit; but with a glass support the same advantage will not accrue. Having got a good thick coating of powder, the mask is removed, but this does not matter very much; it has served its purpose to give a clear edge to the coating. The coated side which must face the tube, if glass is used, is covered with a piece of thin black celluloid, or ebonite, or opaque paper. With vellum, parchment, or paper there should still be a black shield between the tube and the fluorescent salt, but the latter should be left uncovered and facing the eye. The platino-cyanides may be used in the same way, though they do not powder nor sift so finely; or they may be mixed with varnish and spread over a glass or vellum surface; the trouble is to get a really even coating, but with anything but glass one can apply a roller pressure and thus smooth down any unevenness. The easiest way to get an even coating, according to the author, is to use a vehicle of paraffin and petrolatum. Equal parts of each are melted together, stirred until cool, and the powdered salt (about two drachms for a 7 by 5 screen) rubbed on a slab with just enough of the wax mixture to make a workable mass, which is spread by means of a long, straight spatula. An undesirable feature is the liability of the mixture to "run" in a heated atmosphere, but at normal temperature no trouble whatever is encountered.

Workshop Wrinkles and Recipes

[The Editor will be pleased to receive practical hints and recipes suitable for insertion in this column. Such items should be the result of personal experience. Copied matter is not required.]

Pole Testing Paper.—Make a thin solution of white starch and soak strips of thin white blotting paper in it, and set aside in a clean place to dry. Dissolve $\frac{1}{2}$ oz. of potassium iodide in 1 pint of water. Immerse the strips in the solution for a few seconds and again dry. This paper, when moistened and used in the usual way, turns violet at the positive pole.

Cheap Method of Engraving on Steel, etc.—Cover the article with a thin layer of soap and remove the soap with a needle or marker in the design it is required to engrave. Make a powder of equal parts of copper sulphate (bluestone) and common salt, and well sprinkle the design with the mixture. Now cover with sufficient water to dissolve the powder and allow it to stand from twenty to thirty minutes. Then clean off the soap and well wash the article to get rid of the chemicals. This method although not suited for fine work is an excellent way of marking tools, knives, keys, etc.

How to File Aluminium.—"I see a writer in the *Aluminium World* says that filing aluminium is best done with single cut files," said an aluminium worker recently. "With the use of turpentine however," he continued, "I can chew into aluminium very well with a cross cut file. My experience in filing the metal is that, to get the best results, you want to take some stearic acid and dissolve it in turpentine. Turpentine alone would do the business, but in mixing it with stearic acid you save the waste of turpentine in throwing it on to the file. Then, when your file is clogged, just rub on the mixture and scratch off with a file card. By this means you can readily stop the file from clogging. Another thing I have learned in working aluminium is that the metal will grind into shape splendidly on an ordinary grindstone. I cast the metal into the different forms that I wish to use it, and then just step up to the grindstone and grind off all the burrs and roughness, from casting in sand moulds, and the metal then has a sufficiently fine finish for my use."

Model Engineers and Their Work.—II.

Messrs. T. and C. J. Coates.

IF all the model-making and model-loving enthusiasts who have made a pilgrimage to the famous machinery section of the South Kensington Museum, were asked which of the exhibits aroused in them the keenest feelings of interest and admiration, we feel tolerably certain that the majority of the replies would give the place of honour to the sectional model of a London and South Western express locomotive made by the gentleman whose portrait we are pleased to be able to present herewith to our readers. The great publicity given to the handiwork of Mr. Thomas Coates led us to think that some information regarding the conditions and methods pertaining to the production of his models would be of special interest to his many admirers who are supporters of this journal, and we therefore wrote him requesting the favour of an interview for the furtherance of our purpose. His reply, kindly and courteous in the extreme, was pointed with a moral. He wrote: "While I shall be happy to give you the fullest of particulars regarding the models we have made, I am afraid the information will not be of much practical service to your readers, as we can only ascribe our success to a life-long training and experience coupled with an intense personal liking for this particular class of work." While we agree that it will be given to but few of our readers to equal the beauty of workmanship to be found in the models made by the subjects of this sketch, yet we feel that the presentation of such a high ideal will, in itself, act beneficially in encouraging each and all to do their best.

It will be noted that in the foregoing extract from Mr. Coates' letter he uses the plural "we," thereby implying that he does not work alone. Nor does he, for he has a most skilful and valued co-worker in the person of his brother, Mr. Charles James Coates. We had hoped to be able to give this gentleman's portrait, but there are limits to the editorial powers of persuasion, and Mr. Coates' modest refusal of our request proved unalterable.

Many amateurs in speaking to us with regard to Messrs. Coates' work have expressed the opinion that to make such models a most elaborately fitted workshop is necessary, and that no one with but a moderate equipment of tools could in any way hope to equal their productions. The best reply to such a statement is a description of the actual workshop where these models are made, and we would willingly forgive any expressions of doubt which might arise in the reader's mind if he were introduced to the unpretentious building at the bottom of the garden of Mr. Coates' house at Wallington, which though only measuring some 12 by 15 feet, really serves as pattern-making

shop, foundry, and turning and fitting shop, all combined in one. Nor is the equipment so complicated as the imaginative reader might expect, for it consists of two treadle screw-cutting lathes, one of 3-in. and the other of 4-in. centres, one small milling machine, a substantial vice-bench, a natural draught furnace for melting metal, some assorted moulding boxes, and a kit of small tools contained in various drawers and boxes. But such a plant, small though it be, can accomplish much when used with the necessary knowledge and skill.

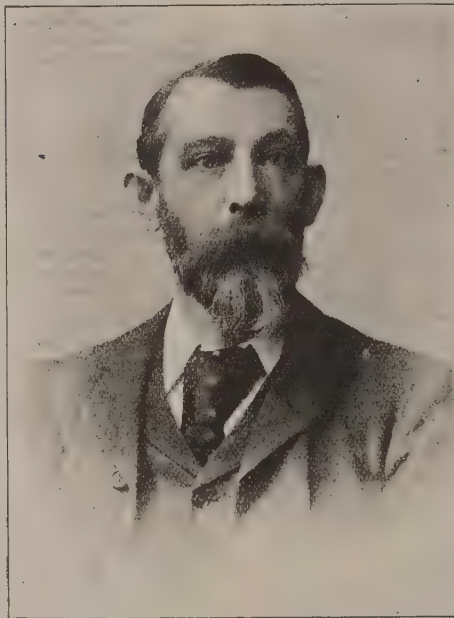
Probably most of our readers have heard the time-honoured story of the great painter who, when asked by a less successful artist what he mixed his colours with to obtain such wonderful results, replied, "With brains, Sir!" The same response might well be applied in

the present case to any inquiry as to the possibility of producing such excellent work with, apparently, such a modestly equipped workshop. The tools themselves are as accurate as skilful adjustment can make them, though we may remark, in passing, that as regards the lathes this accuracy is due to the careful attentions of the present users, and not to those of the original makers. The milling machine above referred to has been specially designed by Mr. Coates for model-making requirements, and will do anything from engraving the smallest letters on an engine's name-plate to the cutting of the most intricate piece of toothed gearing.

All the smaller castings used in the models, both in brass and iron, are made on the spot, the furnace being capable of dealing with 20 lb. of iron, taking about two hours to melt this quantity. For larger castings than this, Mr. Thomas Coates has recourse to the resources of a neighbouring firm of iron-founders, though even in this case he personally prepares the moulds and superintends the melting and pouring of the metal. A question from

us as to the quality of the iron preferred for model-making elicited the information that Mr. Coates uses a mixture of two grades of No. 1 pig iron, from which the sulphur and phosphorus are subsequently refined out.

At the time of our visit, we found that the work in progress consisted of a compound direct-driving vertical electric-light engine, being a model to the scale of 2 ins. to 1 foot of the engines made by the Brush Electrical Engineering Company. The full-sized engine gives 300 h.p. at 250 revolutions per minute. The model varies somewhat from the original in that it is fitted with two distinct types of valve gears—viz., the "Hackworth" gear and the "Marshall" gear, one being fitted to the high-pressure cylinder and the other to the low-pressure



MR. THOMAS COATES.

cylinder. Mr. Coates called our attention to the fact that in several parts of the castings of this engine, as also in other models, the metal is less than $\frac{1}{8}$ in. thick, and therefore requires extreme care and accuracy in the preparation of the patterns and core-boxes, and in inserting the cores when moulding. Indeed, so great is the necessity of accuracy in the construction of the cores that a special method of producing them has to be adopted. As most model-makers are aware, the usual plan is to cut or build up the core-box straightaway from pieces of wood, and only checking the correctness of the work by the ordinary use of templates and foot rule. Sand is then rammed into the box so made to form the core for use in the mould.

Mr. Coates has a more certain method of producing correct cores, which, though it may at first sight seem un-

difference of only 1-32nd in. in the accuracy of the shape of the core or the placing of a print would be sufficient to render the casting useless, and the need of such great care in the preparation of the core-boxes becomes evident.

In this connection we may add that it took just a week to prepare the mould for casting the cylinders of the compound electric light engine referred to. The pattern and core boxes took five weeks to make, and the moulding required a five-part box for its successful accomplishment. This particular engine was nearing completion at the time of our visit, and it has, we believe, now been delivered to the Museum authorities and placed on view at South Kensington. We can sincerely recommend our readers to take an early opportunity of inspecting this, the latest specimen of Messrs. Coates' work.

Before entering into detailed descriptions of other

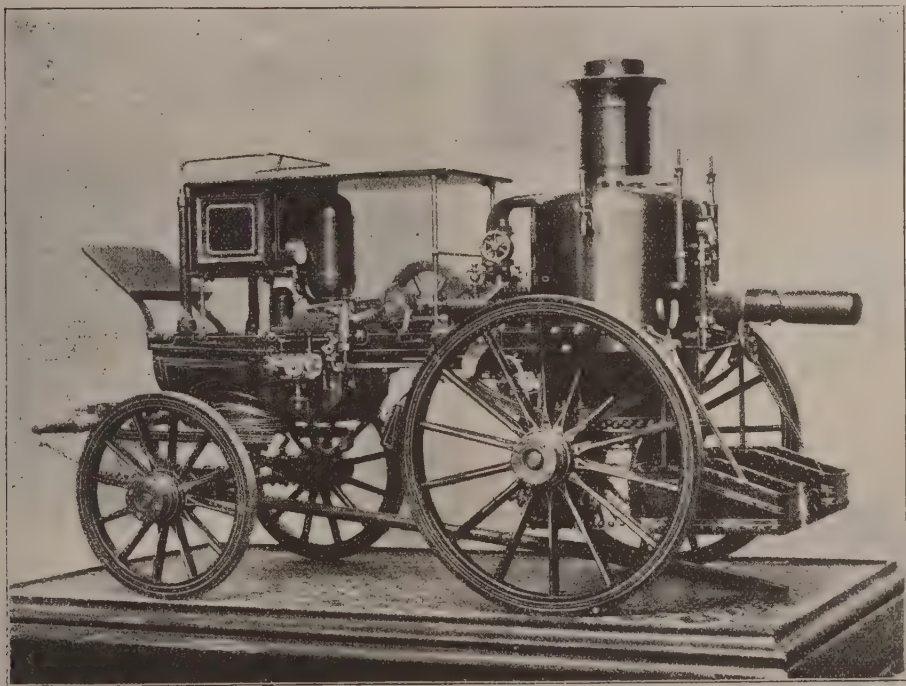


FIG. 1.—MODEL OF STEAM FIRE ENGINE.

necessarily elaborate, has on many occasions proved the means of preventing considerable annoyance and the loss of time and money due to spoilt castings, which would probably have resulted from the employment of a less accurate plan. The following is his *modus operandi*: He first makes as carefully and as exactly as possible a wooden model of the core itself, complete with all the necessary prints; from this model he makes a plaster-of-paris mould in halves, thus forming a core box; he then makes a casting, in zinc or iron, of each half of the plaster box, thus giving him a strong and absolutely accurate core box in which to ram the final sand cores. When one is dealing with castings of which the thickness is in places less than $\frac{1}{8}$ in., it will easily be seen that the

models made by the subjects of our interview, we think, perhaps, a few notes of a personal character will not be out of place. Although both these gentlemen have for many years past been resident in England, it was in Russia that they received their early training, their father having occupied the responsible position of chief superintendent engineer to the Imperial State Paper Factory at St. Petersburg. Some five thousand hands are here employed in the manufacture of all the paper and stationery required by the Russian Government, and in the engineering workshops attached to this huge concern the Messrs. Coates made their first acquaintance with the uses of hammer, chisel, and lathe.

Following their subsequent careers individually, we

learned that Mr. Thomas Coates left St. Petersburg in 1869 to take up a position with Messrs. Smith, of Hamburg, where he was concerned in the construction of a number of gasometers for the principal German gasworks. A year later he joined the steam-yacht "Trave" as chief engineer, and after tasting the joys and sorrows of a sea-going engineer, came over to England and entered the

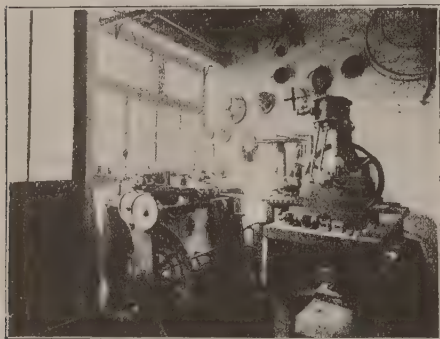


FIG. 2.—MESSRS. COATES' WORKSHOP.

service of the well-known marine engine builders, Messrs. Humphreys, Tennant & Co., of Deptford, as draughtsman. A roving spirit prevailed, however, and he returned to the sea, this time as second engineer of the German Eagle line trans-Atlantic steamer "Goethe." After making seven voyages to America and back, he, fortunately, conceived the idea of settling down in England to take up model making commercially. We say fortunately, because shortly after Mr. Coates resigned his position on the "Goethe" the vessel was wrecked and lost with all hands. Those of our readers who are old enough to remember the "Goethe," will probably recollect that this fine vessel was then the "greyhound of the Atlantic."

Mr. Coates, however, was not yet finished with the

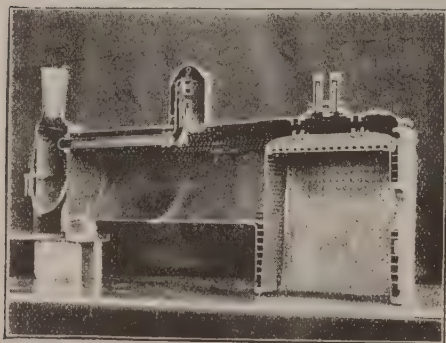


FIG. 3.—BOILER OF L.S.W.R.V. MODEL LOCO. IN COURSE OF CONSTRUCTION.

sea, for, the Egyptian war then being in progress, he was offered and accepted the post of, practically, chief engineer to H.M. troopship "De Bay," though, as is usual in such cases, he was nominally second to a government chief. This interesting experience over, he joined

the staff of the old-established firm of Messrs. James Watt and Co., with whom he remained until 1894, a period of twelve years. While with this firm he did a considerable amount of experimental model making on their behalf, and also conducted many of the contractor's trials of the important waterworks pumping plant for which Messrs. James Watt & Co. were celebrated. Mr. Coates allowed us to peep at the testimonial the firm gave him when he left their service, but about this we will say no more than that the opinions of his abilities therein expressed were such as of which any engineer might well be proud. Even in his apprenticeship days Mr. Coates indulged in model making to a considerable extent, and he told us that it is quite 34 years ago that he turned out his first piece of work of this kind. Since 1894 Mr. Coates has been exclusively engaged in modelling for the South Kensington Museum, though in his spare time he has done work for the authorities for at least ten years past.

Finally, Mr. Thomas Coates is a proficient linguist, speaking English, Russian, French, German and Swedish, holds the Board of Trade's certificate as chief engineer, and is a draughtsman of the first rank, as he proved to us by the production of some of the most beautifully executed engineering drawings we have seen.

Mr. C. J. Coates, like his brother, has had a very

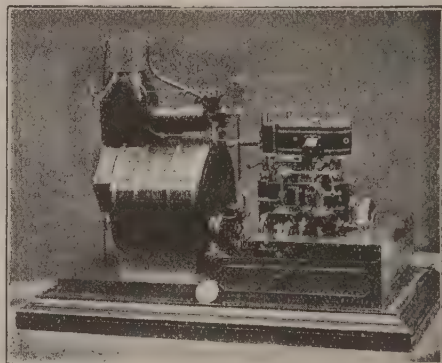


FIG. 4.—MODEL OF COMPOUND MARINE ENGINE AND BOILER

varied experience both on sea and on shore. He learnt to use his tools in the Imperial Factory at St. Petersburg, and, subsequently, spent several years in engineering workshops in Germany. He also was on board the "Goethe," filling the post of third engineer, and in more recent times has taken part in many official trials of torpedo-boats. Space will not permit us to mention all the firms with which he has been associated, but we have only to mention such names as Bryan Donkin & Co., Thorneycroft's, Merryweather's, Rennie, and James Watt and Co., by all of which firms he has, at one time or another, been engaged, to show that his experience in the highest class of engine-building has been considerable. For the last ten or twelve years, however, he has devoted his time entirely to model-making.

It will probably clear up an often-discussed point if we explain that Messrs. Coates do not now look upon their model-making as a source of profit. While it is true that a price is put upon the models they supply to South Kensington, their chief object in undertaking the work is to be found in their intense love for model-making as a pastime, or, rather, we should, perhaps say, as a mechanical art.

(To be continued.)

The Society of Model Engineers.

AT the meeting of the above society, held at the Memorial Hall, Farringdon Street, E.C., on Monday, December 5th, there were about sixty members and friends present. The chairman, Mr. Percival Marshall, announced that there were over forty paying members already on the books of the society, and that a number of further applications for membership had been received by the secretary. Printed application forms were now ready, and could be obtained for the asking by anyone wishing to join. Books of rules, with neat leather cases, were in course of preparation, and would be distributed to the members as soon as ready—probably at the next meeting.

The first portion of the evening was, as usual, devoted to the inspection of models and photographs on view, of which detailed particulars are given below. Messrs. H. W. Cox, Limited, provided a capital display of appliances for x-ray and wireless telegraphy experiments, and kindly sent down an operator and assistant specially to demonstrate the working of the apparatus to the members. Needless to add that this proved a great attraction, and a large number of those present took the opportunity of witnessing the strange revelations of the Röntgen rays. The coil used was an 8-in. spark coil, and was worked from a set of portable accumulators.

Mr. A. M. H. SOLOMON showed a partly completed model of a London and North Western Railway compound locomotive, and also two very fine photographs of locomotives.

Mr. W. J. TENNANT brought a portfolio of photographs, containing some interesting views of famous sailing ships and other marine subjects.

Mr. W. J. TAYLOR exhibited a model launch engine made by a friend, Mr. F. Rose. This was a single cylinder engine, $1\frac{1}{4}$ in. bore by $1\frac{1}{4}$ in. stroke, the total height being 7 ins. The engine is intended for a torpedo-boat destroyer 5 ft. long, now being built. The boat will probably be exhibited at one of the meetings when finished.

Mr. HERBERT HILDERSLY brought a small electric motor measuring $4\frac{1}{2}$ ins. by $2\frac{1}{2}$ ins. by 4 ins. over all. The field magnet is wound with $1\frac{1}{2}$ ozs. of No. 30 B.W.G. wire, and the H-armature with $\frac{1}{2}$ oz. of the same. The dimensions of the armature are 1 in. diameter by $\frac{3}{4}$ in. long. This member also showed a vertical cutter frame adapted for wheel cutting in the lathe.

Mr. F. J. BURNHAM exhibited a small launch engine, made by himself in conjunction with a friend. The principal dimensions are:—Cylinders, $\frac{3}{4}$ in.; bore, 1-in. stroke; crank shaft, $\frac{1}{4}$ in. diameter; the valves are connected to their spindles by loops passing around a raised part at the back, which is recessed to allow the spindle to pass from one side to the other. The spindles are connected to the loops by threads at their ends, which allow of adjustment, and the valves being kept against their faces by light springs within the valve chests. The engine was designed to drive a boat 4 ins. long, with a speed of about 1000 revolutions per minute.

Mr. CHARLES PRICE exhibited the wooden model of a compound marine engine, which was illustrated and described in the last issue of our journal. This, we may state, was very greatly admired by the members.

Messrs. THORPE & SALTER lent one of their new "Ruby" model gas engines, and also a very neat and efficient model centrifugal pump, suitable for working from the engine. Mr. Thorpe, who was present to explain the working of the models, promised to show the pump taken to pieces on a future occasion, so as to make the internal construction clear.

Mr. M. S. DON sent a well made and very complete

scale model of a road locomotive, which proved of much interest. As we hope to give an illustration of this model in an early issue, we will defer a detailed description of the construction.

THE DISCUSSION ON STANDARD GAUGES.

In the absence of Mr. E. L. Pearce, who had promised to read a short paper on "The Desirability of Adopting Standard Gauges for Model Locomotives," Mr. Jas. C. Crebbin, the vice-chairman of the society, consented to open a discussion on this subject.

Mr. CREBBIN suggested that for the sake of fairness in arranging competitions, it would be advisable to fix a standard gauge for the building of all model locomotives. He pointed out that it was difficult to adhere to a scale reduction of the 4 ft. $8\frac{1}{2}$ ins. gauge, as model locomotives required much larger boilers, in proportion, than full-sized engines; and further, in the case of models with inside cylinders, the motion work on the driving axle became very close. He was of opinion that it would be advisable to adopt a broad gauge of, say, for a model $\frac{1}{2}$ in. to a foot, 3 ins. or $3\frac{1}{4}$ ins. gauge instead of $2\frac{1}{2}$ ins. He added that it was his belief that, should the society adopt a standard gauge, professional model makers would also, to a large extent, adopt the same standard, thus creating a universal gauge for models.

Mr. TENNANT spoke in support of the previous speaker's proposal to give model locomotives a broader gauge than that which a strict adherence to scale would produce. He referred also to the desirability of consideration for those who were already committed to a gauge by reason of their possession of models actually completed. Pointing out that there is no objection to running models on the flanges of their wheels instead of on the treads, he said that if run in that fashion, a single track—*i.e.*, a single width of flat plate—would suit all gauges, and that by putting a single low central rail on the rolling stock could readily be guided, *à la* rack railway, by light roller guides clamped to front, and rear buffer beams, and so made as to be easily clamped to any model.

Mr. MONK WHITE said that with reference to rails for testing models, he thought the difficulty would be the various widths and gauges to which they were likely to be made; therefore Mr. Tennant's idea seemed very good. The suggested arrangement could easily be fixed to any model, and as the engines in turn would be subject to the same friction, one would be able to judge more accurately the power and capability of each model in case of competition or trial.

Mr. A. M. H. SOLOMON said that for purposes of comparison and appearance there is desirability for uniformity in gauge, although the general dimensions of a model would be mostly governed by the gauge. In building it is impossible to work exactly to scale. While general lines can be followed, the boiler of a model has frequently to be larger than it would be permissible to introduce were the scale rigorously followed. He did not suggest that particular scales be followed, but particular gauges. There are, apparently, two classes of amateurs at work, or about to work, on model locomotives—those who make small models and those who go in for large-sized productions. He would, therefore, suggest that two standards of gauge be recommended to those about to construct a model railway or a locomotive, and he hoped to see a recommendation of this kind adopted. For small models he advised a gauge between 3 in. and $3\frac{1}{2}$ in. Having made some engines with $3\frac{3}{16}$ ins. gauge (width between insides of flanges, 3 ins. exact, he found from experience that this is a very handy width. The scale is a little larger than $\frac{3}{8}$ in. to the foot for the 4 ft. $8\frac{1}{2}$ ins. gauge, and a model, according to the class of engine constructed, can be from 14 ins. to 20 ins. long, which is

a fair size; this is excluding a tender. This gauge of 3 3-16ths ins. does not require the engine to have a long wheel base, hence ability to traverse curves of small radius—an important factor for those whose rooms or gardens are limited in size. Space is also allowed for a good-sized boiler, capable of providing ample steam, and the model will not weigh so much as to prevent its portability by the owner. It is not all of us who care to take the work of our leisure to the tender mercies of the carriers for purposes of transport. Altogether, a very nice and fairly powerful model can be constructed to run upon a track of 3 3-16ths in. gauge—one that does not require a great amount of mechanical skill to complete, nor elaborate or expensive tools or material. For those interested in larger-sized models he would suggest a gauge of $4\frac{1}{2}$ ins. to 5 ins.—say the latter—which on a scale model provides for the very necessary enlargement of a boiler in an engine constructed about 1 in. scale to our national gauge.

Mr. W. BLAMEY suggested that the difficulty of standard gauges might be met in another way, *i.e.*, by constructing a convertible or adjustable track. He exhibited and explained a rough model section to illustrate the idea, and promised to produce a more complete model to show how to adjust the gauge at the curves at the next meeting.

The model shown consisted of three parallel rails, two of which were fixed, the third or outer rail sliding laterally on the sleepers, and being clamped to them by small bolts and fly-nuts.

Mr. REGINALD MARSHALL thought that in model locomotive building there was much scope for original design on the part of the model maker, although in making a model of any particular class of engine the general proportions might be adhered to. He thought Mr. Tennant's suggestion was a good one, inasmuch as it would not restrict the designs of those who made models so much as if a standard gauge had to be necessarily adopted.

Mr. F. E. POWELL suggested that the members of the society should follow the example set by one member (Mr. Blamey), and make working models of the apparatus proposed by Mr. Tennant for use with a central rail. These various schemes could then be inspected at the next meeting, and would add to the interest of the discussion.

[Mr. MONK WHITE thereupon expressed his willingness to make, in time for the next meeting, an example of the construction above suggested.

Mr. HERBERT SANDERSON considered that both the central rail and standard gauge rails should be provided, as double rail tracks were advisable for testing since the balance and friction and position of wheels so influenced the capability of a locomotive; the single rail being necessary for locomotives of other than the standard gauge.

The CHAIRMAN said that judging from the variety of opinions expressed in the course of the discussion, it was hardly possible for the society to come to a definite decision on so important a subject at that meeting. He, therefore, proposed that the discussion be adjourned, and be resumed at the next meeting, when the members would have the suggested models before them, and could form a better opinion as to their merits. He thought it probable that the "battle of the gauges" could best be decided by appointing a sub-committee to thoroughly investigate the *pros* and *cons* of the question, and to make a recommendation to the society as the result of their deliberations. This, however, was a matter which could be decided upon at the termination of the present open discussion.

The proposal to adjourn the discussion till the next

meeting having been agreed to, the proceedings terminated with the usual vote of thanks.

THE NEXT MEETINGS.

The next meeting of the society will be held at the Memorial Hall, Farringdon Street, E.C., on Tuesday, January 3rd, 1899, at 7 p.m. Mr. W. J. Tennant will give a short lecture on "Locomotives," illustrated by a very fine series of lantern slides. There will be the usual display of members' models, amongst those already promised being a model of one of the G.W.R., "Pendennis Castle" type of engines. This is a four-coupled engine (outside bearings), with radial bogie (inside bearings), the gauge being 2 ins. The cylinders are $\frac{5}{8}$ in. bore by $1\frac{1}{4}$ in. bore by $1\frac{1}{4}$ in. stroke. It has Stephenson link motion, and valves placed in one steam chest on top of cylinders.

The following meeting will take place on Wednesday, February 1st.

NOTICE TO INTENDING MEMBERS.

Membership application forms and full particulars as to subscription, &c., can be obtained from Mr. Herbert Sanderson, hon. secretary, Society of Model Engineers, "The Mount," Ealing, W. No entrance fee will be required if application is made before January 1st.

How to Make a Small Gas-Engine.

By "ATLAS."

(Continued from page 224, Vol. I.)

WE now proceed to the bearings, which are cast in one piece. This gives greater strength and rigidity and simplifies the fitting up. First file up the bottom, then the two outsides at right angles with the bottom; after this the inner sides and top of bottom plate. Now fit in the caps, and this must be done carefully, since these caps must fit perfectly tight on all three sides. A space of $\frac{1}{8}$ in. should be between the top of bearings and the ears of the caps; next drill $\frac{1}{8}$ in. holes through the ears of caps and into the bearings; tap the latter for 3-16ths in. Whitworth thread; open the holes in the caps to let the 3-16ths in. screws pass through, and screw caps to bearings; now file up the caps to correspond with the bearings; mark the caps and also the screws according to the holes to which they belong; next mark centre for $\frac{3}{4}$ in. hole to go right through bearing, that is half through bearings, the other half through the caps. This is done best by putting the bearings on a surface-plate, and marking off the height with a scribing-block; drill a hole of $\frac{3}{4}$ in. through both cheeks of bearing. Into these holes the gun-metal bushes are to be fitted. These are first drilled and reamed to $\frac{5}{8}$ in. bore, then driven on a mandrel, and the faces turned up; then turn the outside to 1 in. diameter. You must now caliper the thickness of each cheek of the bearings (which should be alike), and turn a groove $\frac{1}{8}$ in. deep, and so wide that the bushes will fit into the $\frac{3}{4}$ in. holes drilled through the bearings; fit bushes into bearings, and screw tight; next drill $\frac{1}{8}$ in. holes through caps and bushes, and fit into these holes short lengths of $\frac{1}{2}$ in. brass rod. These rods serve the purpose of preventing the bushes from turning round when engine runs, and as they are to be drilled 1-16th in, they also serve to pass the lubricating oil from the cups to the crank axle. These rods should be cut flush with top of caps.

Next take the bushes out of the bearings again, drive them on a wooden core, and cut them with a hacksaw

into two exact halves, afterwards filing the edges flat. Put bushes into bearings again; screw caps down tight, when the edges of the top halves should rest on the edges of the lower halves. The holes in the bushes will now not be round, on account of the metal removed by the saw-cuts. Put in the $\frac{1}{4}$ in. brass rod, and drill and reamer again to $\frac{5}{16}$ in. While still in the bearings, mark or number each half of the two bushes to correspond with marks or numbers on the cheeks of bearings. This will ensure the bushes being put into their right places again.

We now turn the spindle from $\frac{3}{4}$ in. mild steel, 7 in. long; very carefully centre, and put between lathe centres. As the axle is to be left $\frac{3}{4}$ in. in two places, it is most important that it should run perfectly true. Start on the right-hand end and turn a journal $\frac{3}{4}$ in. from the end to length corresponding exactly with the near side bush in bearing when you look at these in the position they are to take, which should be $\frac{7}{16}$ in.; turn this journal to $\frac{5}{16}$ in. Place axle on the bearings and mark off the place for the second journal, the first journal resting in its bearing, and turn the second journal to $\frac{5}{16}$ in. diameter, $\frac{7}{16}$ in. long. It is only necessary to have the bottom half of gunmetal bushes in the bearings when marking off the places for the journals; $1\frac{1}{4}$ in. from the second journal turn down the axle to $\frac{5}{16}$ in. to the end, for which operation the work may be turned round in the centres. This end is to take the flywheel. Try the fit of the axle in the bearing with caps screwed down. The axle should turn in the bearings stiffly, yet not so stiffly, as to prevent the edges of the bushes lying against each other.

Take the axle out again, and fit on the small gear-wheel between the two journals. This gear wheel is bored to nearly $\frac{3}{4}$ in. Make it a good fit on the spindle. See that it clears the bushes. Drill $\frac{7}{16}$ in. hole through the boss of gear wheel half-way into the spindle, tap the latter 3-16ths in., and fix gear-wheel in position with a setscrew, which must be cut just long enough that its head can be screwed right down on the boss of gear-wheel. Now chuck the crank disc on a face plate or three-jawed chuck, boss side outward, get it to run true, find centre, and drill $\frac{7}{16}$ in. hole through the boss. Turn out this hole taper from $\frac{3}{4}$ in. to 11-16ths in.—the nose of a $\frac{3}{4}$ in. reamer is just the right tool to give the proper taper—the wider opening to be on the boss side, the smaller one on the flat side. Then turn the $\frac{3}{4}$ in. end of axle to the same taper, making a good tight fit, and drive spindle in the disc. Turn the latter while on the spindle, face up front, also take a slight cut off boss. Try the axle and disc again in the bearings. Should the boss run too close to the bearing, a little more should be turned off. Next polish face of disc by means of emery cloth and stick, the stick of wood being pressed against the T-rest. Use plenty of oil while polishing, since emery cloth alone soon clogs and refuses to work. Next drive axle out of disc again and cut a keyway in the tapering part 3-16th-in. deep $\frac{1}{4}$ in. wide; file a corresponding keyway into the hole in disc. Fit a key to this. This must be done most accurately, since, first, the thrust of piston stroke during the explosion is very considerable; and, second, the back pressure of compression stroke tends to turn the disc in opposite direction. The key must therefore have no possibility of moving.

The same remarks are good for the key for flywheel. The flywheel is bored $\frac{7}{16}$ in. and rests against the shoulder of the original $\frac{3}{4}$ in. spindle, its boss being $1\frac{1}{2}$ in. long. A keyway of this length should be cut in the $\frac{1}{2}$ in. part of spindle, also inside the boss. The key for the flywheel must likewise be a perfect fit for above stated reasons. Steel is best for these keys, which, however, need not be hardened.

The disc pin is turned of $\frac{1}{2}$ in. silver steel; centre and put into lathe. Turn to $\frac{3}{8}$ in. diameter for $\frac{1}{2}$ in. from right-hand end, which will be screwed $\frac{3}{8}$ in. Whitworth thread; next to this, to form a shoulder, leave the $\frac{1}{2}$ in. diameter for $\frac{1}{2}$ in.; then turn journal, 9-16ths in. long, 7-16ths in. diameter. The pin is next left for $\frac{1}{2}$ in. length at $\frac{1}{2}$ in. diameter, and the rest turned down to $\frac{3}{8}$ in. diameter; the shoulder where the two diameters meet being turned to a radius, to give a nice appearance. Through the $\frac{1}{2}$ in. by $\frac{1}{2}$ in. part a "tommy" hole of 3-16ths in. diameter must be drilled, by means of which the pin can be firmly screwed into the disc. Next drill a 5-16ths in. hole through the disc $1\frac{1}{2}$ ins. from centre; tap this $\frac{3}{8}$ in. Whitworth thread, and screw into this the disc pin tightly. Care must be used to get the hole in the disc perfectly straight, *i.e.*, at right angles with the outside of the disc.

We must now cut the front end of connecting-rod in two parts, cutting right through the 7-16ths in. hole, parallel to the front edge. Before doing this, however, two 1-16th in. screws one inch long must be fitted from the front into the back. To do this the two corners may be filed out for $\frac{1}{2}$ in. If this is not done, the screws should be $\frac{1}{2}$ in. larger. Screws being fitted, take these out again and cut through the hole; file the two ends flat; then drill and reamer the hole again to 7-16ths in. Into this hole fits the journal of disc pin.

We now have to fix the bearings in their places. The casting must, of course, be filed flat and level to correspond with the facing in front of the bed. Through the ears of the bottom plate of the casting clearing holes for $\frac{3}{8}$ -in. setscrews are drilled; these are marked off on the face of the bed, then centered, and 5-16th in. holes drilled and tapped, $\frac{3}{8}$ -in. Whitworth thread. Now put bearings on again, and screw down firmly on the bed.

It is necessary to slightly loosen the screws which hold the cylinder down. Then insert piston into the cylinder and connect the large connecting-rod end to the crank-pin. Screw down the outer of the cylinder screws, and try the running of the spindle with the piston in its place. It is, of course, necessary that the back end of cylinder should be in communication with the atmosphere, otherwise compression might be taken as the cause why the piston and spindle will not run.

If bearings and cylinder are exactly in line, spindle and piston should work easily, but it is possible that either the one or the other may be slightly out of line, when the spindle would work easily in some positions, and tightly in others. Find these out by moving the front end of cylinder slightly to one side or the other, and try the running again; for this purpose the hole in the cylinder base for the inner screw must have been filed out a bit to give the necessary play.

When you find the piston and spindle moving equally well throughout, screw down the inner screw tightly. Now put the flywheel on spindle, and key this on tightly. Between the bearings on the spindle is held the small gear-wheel by a 3-16th-in. setscrew. The large gear-wheel requires a bearing of its own, which consists of a cast iron bracket. Through the boss of the latter a $\frac{1}{4}$ -in. hole is drilled and reamed, both sides filed or turned square; also the bottom, through which a $\frac{1}{4}$ -in. hole is to be drilled. A $\frac{3}{8}$ in. steel rod about 3 in. long is centered, and one end slightly tapered in the lathe for $\frac{1}{4}$ in. length, *i.e.*, thickness of large gear-wheel. The latter is then put in a three-jawed chuck and its hole slightly enlarged to take the taper end of the $\frac{3}{8}$ -in. steel rod. This is then driven into the hole in the large gear-wheel flush with one side, chucked again by the gear-wheel, and supported on the other end of steel rod by back centre. The steel rod is then turned $\frac{1}{4}$ in. for its

whole length, and this must be a good working fit in the boss hole of the bracket.

Now drill an oil-hole in the bracket, also another hole in slanting direction, in which small pointed setscrew is fitted; insert the spindle with gear-wheel into bracket, and mark off the slanting hole on the spindle, and turn a shallow groove in the spindle in which the point of the small screw engages, and thus keeps the spindle with gear-wheel in its proper position. A glance at the drawings (plan) will make this clear.

Now take bracket with spindle and gear-wheel, and place it on top of bed; move it towards the small gear-wheel and let the teeth of both engage, but not too tightly. Then mark off the hole in the bottom of bracket on top of bed, centre, and drill 3-16ths in. right through. Screw this $\frac{1}{4}$ in. Whitworth thread; from underneath screw through this hole a $\frac{1}{4}$ in. Whitworth thread screw, $1\frac{1}{2}$ in. long, put bracket in place, and tighten by means of a nut. This nut is not to be screwed on finally. Remove spindle and large gear-wheel from bracket; mark off centre for a hole 13-32nds. in. from centre of spindle; drill $\frac{1}{8}$ in. and tap 3-16ths in. Whitworth thread. Into this hole a flat-headed screw is fitted, which has a collar $\frac{1}{4}$ in. diameter, $\frac{1}{8}$ in. long. This screw forms a crank pin for operating the exhaust valve rod. This brass rod for exhaust is best made of a flat strip $\frac{1}{8}$ in. thick, $\frac{1}{2}$ in. wide, and 9 ins. long. Both ends are drilled 3-16ths in. diameter, $\frac{3}{8}$ in. from end, the ends filed half round for appearance, and one end bent in right angle for $\frac{3}{8}$ in.

Now put the piston to 4-5ths of its stroke; screw exhaust brass rod by means of flatheaded screw to gear-wheel; put the latter with exhaust rod on its bracket, but not so close as to let the teeth of both gear-wheels engage; put the brass rod on to exhaust valve stem; turn the large gear wheel overhand till the bent part of brass rod lays against the pin of exhaust valve rod; then push on large gear-wheel, letting the teeth of both engage, and screw nut on to $\frac{1}{4}$ in. screw by means of which the bracket is held down on bed; then push in the pin which holds spindle of gear-wheel in its right place in bracket. It will now be seen on turning the flywheel round that the exhaust valve is opened once for every two revolutions of flywheel.

The ignition-tube consists of a piece of $\frac{1}{8}$ in. gas piping, $3\frac{1}{2}$ ins. long, one end of which is closed by an $\frac{1}{8}$ in. cap. The other end is screwed into a round elbow, $\frac{1}{8}$ in. one end, $\frac{1}{4}$ in. the other. This latter end of elbow has a $\frac{1}{4}$ in. union screwed in. This union consists of a piece of iron tubing, $\frac{3}{4}$ in. long, screwed $\frac{1}{4}$ in. gas thread, in the middle of which is a hexagon collar. The free end is screwed into the hole in back end of cylinder, which is tapped $\frac{1}{4}$ in. gas.

All these joints must be made perfectly air tight, and it is advisable to use linseed oil and red lead for this purpose.

You can now try again whether the compression is complete, and if so, you will see the compressed air in cylinder give the axle of engine at least one complete turn, if you bring the piston far enough back. To heat the ignition-tube for igniting the charge, a chimney must be put round the tube. This chimney is made of a sheet of iron or steel 1-16th in. thick, 5 ins. high, by $4\frac{1}{2}$ in. rolled perfectly round, making a tube both ends open, and $1\frac{1}{2}$ ins. inside diameter. In one end of this tube, which I will call the bottom end, a 3-16ths in. hole is drilled and tap $\frac{1}{4}$ in. Whitworth thread, a short $\frac{1}{4}$ in. setscrew with slotted head is fitted in this. By means of this screw and a bracket the chimney is held in position. The bracket is made of a piece of strip iron $\frac{1}{2}$ in. wide, $\frac{1}{8}$ in. thick, $2\frac{1}{2}$ ins. long, bent into a right angle, one end $1\frac{1}{2}$ ins. long. This end is slotted for $1\frac{1}{2}$ ins., to

allow the chimney to be screwed in various positions by means of the $\frac{1}{4}$ in. screw. The smaller end of this bracket is fastened on to the projection on the back cylinder cover by means of a $\frac{1}{4}$ in. setscrew with slotted head. The hole for this screw will meet the gas and air passage in the projection, therefore the screw must be a tight fit, since this is another place where the compressed charge might escape.

The right position of this screw and chimney, &c., can be found by placing the chimney over ignition-tube, letting the bottom of chimney rest on the elbow. The ignition-tube should be exactly in the middle of the chimney. Put chimney into its place and screw on. $\frac{1}{8}$ in. from bottom end of chimney on the opposite side of bracket and at right angles to ignition-tube, centre and drill hole, and tap this $\frac{1}{8}$ -in. gas thread.

Into this hole the Bunsen burner is screwed. This burner is made of a piece of this brass tubing $\frac{3}{8}$ -in. diameter, $3\frac{1}{2}$ in. long, one end of which is screwed $\frac{1}{8}$ in. gas to correspond with hole in chimney. Into the other end a small gas-tap (so-called pipe-lights) is fitted by plugging up the hole of the brass tubing for $\frac{1}{4}$ in. drill into this plug a hole, into which the tapering end of tap is fitted or screwed. Now cut away the sides of the brass tubing $\frac{1}{4}$ in. from the end for $\frac{1}{2}$ in., leaving two narrow strips of metal. The tapering part of tap being $\frac{3}{4}$ in. long, it should just end where the brass tubing is solid again. When gas is applied by means of rubber tubing to the tap and the latter turned on, the gas will draw a quantity of air by suction, and by applying a light to the outlet of the tube a blue flame will appear, which has great heating power. This is the principle of a Bunsen burner, with which most of my readers will be conversant. See that the flame plays exactly at right angle on the ignition-tube. The chimney must be lined with asbestos sheet $\frac{1}{8}$ in. or 1-16th in. thick, to keep the heat in.

Gas and air are supplied to the engine by means of the gas and air inlet valve, but separate pipes or tubes are required for each. This gas and air admission valve is drilled and tapped with two $\frac{3}{8}$ in. Whitworth thread holes, one vertical, and the other horizontal. Into the horizontal hole a short piece of $\frac{3}{8}$ in. brass tubing is fitted about 4 ins. long. Over this tube goes another light brass tube 9 ins. long, and slides on the 4-in. tube. This is the air inlet. Into the vertical hole screw a 3-in. to 4-in. long brass tube of $\frac{3}{8}$ in. outside dia., in which, at the free end, a small gas tap is fitted, similar to the one used for the Bunsen burner. If a so-called pipe light is used for this tap, it should first be bored to $\frac{1}{8}$ in. diameter, the cock, of course, must stand at the "open" during widening the passage. The boss end of the tap is screwed into a suitable brass elbow, into the other opening of this elbow is also screwed a connecting pipe of "compo," which comes from the gas-bag or gas supply.

A 3-16ths in. hole is drilled through one of the flat sides of the elbow, into which a short length of 3-16ths in. brass tube is fitted and soldered to make a gas-tight joint. From this small tube a piece of india-rubber tubing makes connection to the Bunsen burner. Connect the gas supply to gas-bag, and gas-bag to the elbow. Next screw a $\frac{1}{4}$ -in. gas-pipe in the hole in the exhaust-valve, which is tapped $\frac{1}{4}$ in. gas thread, to carry off the exhaust gases into a convenient chimney or to the outer atmosphere.

We are now ready to try the engine, and must bolt it down on a heavy plank, which itself is bolted to the floor or other suitable support. Light up Bunsen burner, and while the ignition-tube is getting red-hot, oil up the bearings and piston. Stop up the hole at bottom of water-jacket; fill the latter with water. Now, supposing the ignition-tube to be red hot, it should not take longer than about five minutes to properly heat it. Turn on gas-tap to gas inlet valve, press in gas and air inlet valve, when you will be

able to give the engine a few turns by using the disc pin as a handle; let go the back valve and an explosion should take place, providing (1) the compression is complete; (2) the ignition-tube is heated in the proper place; (3) the gas and air supply comes in the proper mixture into the cylinder.

If the engine runs, let it do so for a few minutes only, as you have no proper water supply yet to keep cylinder cool, otherwise the liner will soon become unsoldered. The water inside the water-jacket will boil up and over, and it is necessary to stop the engine then and fill the water-jacket right up again and let it get cool.

How to make a water tank need hardly be said, a zinc pail would do for emergency, but I will say a few words about the size of it in my next paper.

If the engine refuses to go, you must look for the causes of failure among the essential provisions mentioned above, the most likely cause being the wrong mixture of explosive charge, which should be about six of air and one of gas. It is advisable to try the running with the gas-taps opened to various degrees.

If an explosion takes place before the piston has completed the compression stroke and the engine "fires back," the ignition-tube is heated too low. If no explosion takes place the ignition-tube is heated too high. The remedies are obvious. But above all have the compression perfect.

(To be concluded.)

How to Make a Five-Inch Screw-Cutting Lathe.

By WALLER MARTIN.

A SCREW-CUTTING lathe is always considered to be the ideal tool among amateur mechanics, but, unfortunately, many may not have the spare cash to buy a finished lathe such as I am about to describe, and it is to this class of reader that I propose showing how they may make one for themselves (provided that they possess some of the usual metal-working tools and know fairly well how to use them) at the cost of materials, in the rough or partly finished state, and time. As winter approaches, the usual question asked by amateur mechanics is—What can I make this winter? and is answered by the determination to start and "finish" a screw-cutting lathe.

In the first place, it would be a great boon if a mechanical friend's screw-cutting lathe is available for use in screw-cutting the square thread-screws; failing this, the builder will have to put the leading and slide rest screws out to be cut, as also will probably be the case with planing the bed and slides—parts that must be absolutely true and machine planed to be of any service.

Providing a set of 5-in. lathe castings, we start building by taking the heads first. The fast head (Figs. 1, 2, 3) is shown in elevation, half plan and section; these, as the rest of drawings, are to scale. The two core holes in front bosses are temporarily bridged across by fitting tightly a piece of hard wood, previous to marking out the head for boring. The pieces of wood and the back bosses must be chalked over thoroughly to show lines that must be marked with a scribing block. Place the head upon a planed surface plate, lathe bed, or other true surface, and wedge it up firmly, so that it does not rock about whilst being marked off. A line will be marked in a horizontal direction across the centres of front and back bosses; this line must be $\frac{5}{8}$ ins. from bottom of head, where it fits bed to centre of mandrel. The position of head casting will now be altered on surface plate to right

angles with the line just marked, and when wedged firmly, a line at right angles to first and across the centres of mandrel bosses in front and back of head, a second line will be marked in a parallel plane at $3\frac{3}{8}$ ins. centres, which gives the correct distance for the centres of the gear wheels when in and out of gear, the eccentric back shaft allowing the latitude necessary.

In all marking-off operations both ends of a casting will be marked before the casting is moved in any way. Circles are marked with dividers, sizes of which are given in drawings. All lines and circles marked will be centred popped lightly in order to show where to machine to should the lines become rubbed out whilst handling casting, and also as a safeguard to show when castings are correctly chucked before boring holes out, which are now ready to be done, preferably upon the saddle of a screw-cutting lathe, and a boring bar and cutter between lathe centres. The loose head is marked off in a similar manner, but is much easier by reason of the casting having only one hole. In boring the fast head it is chucked true to the scribed circle on mandrel boss, and several cuts taken through—the last cut must be very light, just a scrape, in fact, in order to get a round hole, and to this end a boring bar just large enough to slip through the core hole is wanted, as, with a stout bar, chatter and spring of the bar whilst cutting is reduced to the minimum. After these bosses are bored, true to size and perfectly parallel, the head will be unchucked.

It will be noticed the back shaft bosses are cast solid. This is essential to get a sound casting; therefore it will be necessary to drill a hole in each sufficiently large to admit of a boring bar being put through. Head will now be re-chucked to bore all the back shaft bosses, and every care must be taken to see the holes are very accurately done and quite parallel with each other. A slight radius in front boss will put a neater finish to the head; a round nose nib, or cutter, being put in boring bar and fed slowly on to boss. The loose head will now be taken in hand for boring. Several cuts will be necessary, and in the event of the lathe not being in good trim, bore out to 1-32nd in. less than the $1\frac{1}{8}$ in., and if a $1\frac{1}{8}$ in. reamer is handy, run this through, thus getting the perfectly parallel hole so necessary.

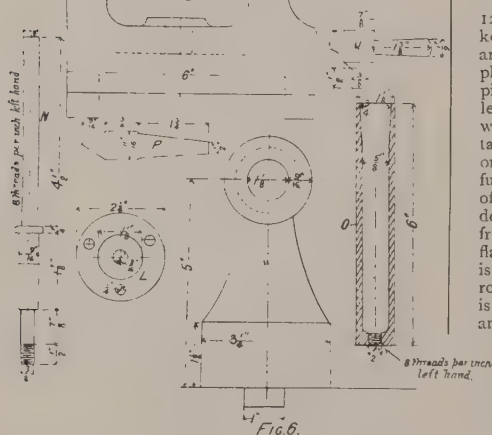
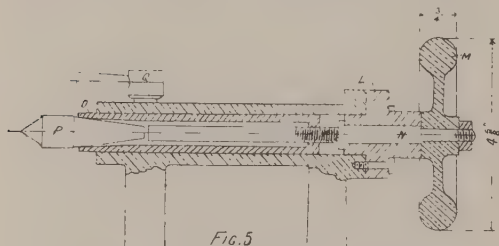
The heads can now be planed on bottom surfaces, a mandrel being inserted through bored holes in each head, the mandrel being supported and bolted to V blocks and chucked on planing machine table. It will be seen that the tenon pieces on loose head are to be planed exactly 1 in. in width, whilst those in fast head are $\frac{3}{8}$ in. These are drilled and tapped for $\frac{3}{8}$ in. screws, exactly 1 in. in length, to fit between slot in bed. Both heads being planed together on the same mandrel ensures absolute accuracy. The distance from centre of mandrel to planed surface will, of course, be 5 in.

After planing heads as described, the headstock will have the sides and back planed up, as will also the loose head. This is not essential if a neat finish is not thought of much moment, and, as it does not affect the accuracy of the lathe when completed, it is quite optional.

The bushes for mandrel to run in will now be fitted; they may be made of steel, phosphor bronze, or hard gunmetal. Bore out first and finish very smoothly, the inner conical diameter to $1\frac{1}{8}$ ins. at front, $1\frac{1}{8}$ ins. back; then turn a taper mandrel to exactly fit conical hole, drive bush in, and turn outer diameter to fit holes bored in head; these must be an exact fit, and should be such that they may be drawn in to their proper place by a $\frac{1}{2}$ in. bolt and drawn home by screwing up the nut. These being nicely fitted, the four-speed cone pulley F will be bored $\frac{7}{8}$ in., and then placed on a mandrel and turned up on each speed, and a light cut taken over the top of pinion teeth. The loose gear wheel E is bored to 15-16ths in.,

put on a mandrel, and turned up over all. A very good finish must be left on front face, also on speed cone (a very sharp tool, and emery paper of varying degrees will get this high polish). A keyway must be cut in boss $\frac{1}{4}$ in. wide by 3-16ths in. deep, to key to mandrel by. A slot will also have to be filed out to allow the gear-locking nut to slide in; size to file slot— $\frac{1}{2}$ in. wide, 1 $\frac{1}{2}$ in. long. This slot should be over keyway.

We now make the mandrel A from a cast steel forging and turn to sizes given, great care being taken to make an exact fit of coned part in mandrel, also the loose cone which fits on tail end of mandrel. The cone must have a keyway filed throughout its entire length, and a key to correspond will be fitted to mandrel to prevent the cone running separate from mandrel; fit key in mandrel to take loose cone, and cut 1 in. standard Whitworth thread on nose, and $\frac{3}{8}$ 18ths per 1 in. on tail end. The conical



hole for centre in mandrel nose will be drilled, and afterwards bored conical, when the lathe is almost finished. Two studs (G) may be made from mild steel to sizes and threads given $\frac{3}{8}$ in. Tapping holes (5-16ths in.) will be drilled and tapped in back of headstock to take these studs. These holes will be drilled at 3 $\frac{3}{8}$ ins. centres.

The bridge piece (J) of cast iron will be filed to sizes, and have a $\frac{3}{8}$ in. hole drilled in centre to receive a hardened steel thrust pin; two 7-16ths in. clearing holes will be drilled at 3 $\frac{3}{8}$ ins. centres to slip over the studs. The mandrel will be hardened for $\frac{1}{2}$ in. up on tail end. Two lock nuts are now fitted to mandrel tail end to lock and adjust back cone, and to take up wear, a flat will be filed on $\frac{1}{2}$ in. plain part of mandrel to take key holding

the pinion. The back gear wheel and pinion (H) cast in one is carefully chucked dead true and drilled $\frac{1}{2}$ in.; it will then be turned up over all on a mandrel preferably to the alternative plan of between centres without a mandrel.

The eccentric mandrel B is turned up from a mild steel forging. Chuck it to turn the $\frac{1}{2}$ in. diameter part first on which the back gear wheels run. When this is done fresh centres will be made $\frac{1}{2}$ in. from those used; then turn the large part up; turn and fit large part to fit bored hole in head; fit so that it will revolve freely without shake or play. Drill a $\frac{3}{8}$ -in. hole $\frac{1}{2}$ in. out of centre in the mild steel forging of loose eccentric, when it can be either turned up upon its own mandrel, or on a short mandrel specially made, and with centres $\frac{1}{2}$ in. out, and turned to fit head. The handle (I) to pull the eccentric in or out of gear with will be turned to sizes and fitted to the eccentric mandrel. Put the eccentric mandrel in head, and drive the loose eccentric D carefully and in correct line on to mandrel. If it has been nicely done it should revolve easily; if not, probably the two eccentrics are not quite in line. Correct if out, and drill a 3-16th-in. hole halfway in eccentric mandrel B, and halfway in loose eccentric D, and a steel pin may be driven in, or, alternatively, a $\frac{1}{4}$ -in. thread may be tapped and a screw used; either plan is correct so long as the end in view (to hold D firmly to B) is attained. The rocking-plate (R) for the reversing gear for altering the direction of the change wheels actuating the leading screw in cutting right or left-hand screws, or self-acting right or left hand, is now proceeded with.

The reversing gear wheels consist of four wheels of 12-pitch, each having twenty-four teeth. One of these is keyed to tail-end of mandrel, and, like the rocking-plate, are made from cast iron; mark off, and drill holes in plate casting, as per drawings shown (Fig. 4). A pivot-pin is turned $\frac{1}{2}$ in. diameter by 1 in. long; a collar is left on material, which is preferably of mild steel $\frac{3}{8}$ in. wide, 1 in. diameter. This collar has two flats, filed to take a spanner, turn along for $\frac{3}{4}$ in. by $\frac{5}{8}$ in. diameter, on which part the rocking-plate pivots; turn along $\frac{1}{4}$ in. further by $\frac{1}{2}$ in. diameter. This part is fitted with one of the twenty-four wheels in a sleeve, to be afterwards described, with change wheels. The stud bolt K is turned from piece of mild steel; short end is screwed $\frac{3}{8}$ in., six flats being filed to take spanner; a $\frac{3}{8}$ -in. screw thread is tapped in head directly under centre of oblong slot in rocking-plate. The reversing-wheel pinion on mandrel is drilled out $\frac{1}{2}$ in. diameter; two are drilled out $\frac{5}{8}$ in.; and the fourth is drilled 1 in. Two steel pins with slight collars on must be turned from $\frac{3}{8}$ -in. diameter rod (this leaves one-eighth of a side for a shoulder) to $\frac{5}{8}$ in. diameter for the two wheels to revolve on, being then turned to 7-16ths in. to fit holes in rocking-plate, and held by a $\frac{3}{8}$ -in. nut on other side of rocking-plate.

The part on pivot-pin $\frac{1}{2}$ in. diameter, 1 in. long, is screwed, and a corresponding screw is tapped to receive it in a central line directly under mandrel intread, at such a distance that when the rocking-plate with the two pinion wheels are fitted, and that when these wheels are out of gear, the $\frac{3}{8}$ in. stud-bolt hole will be in the centre of the slot. By pulling the handle of the rocking-plate either up or down the right or left-hand pinion on the rocking-plate should gear into the pinion on the mandrel end. When out of gear, the wheels just want to be clear.

(To be continued.)

[NOTE.—Castings suitable for making the lathe described in this article are supplied by Messrs. Martin and Co., East Road, West Ham, London, E.—Ed. M. E.]

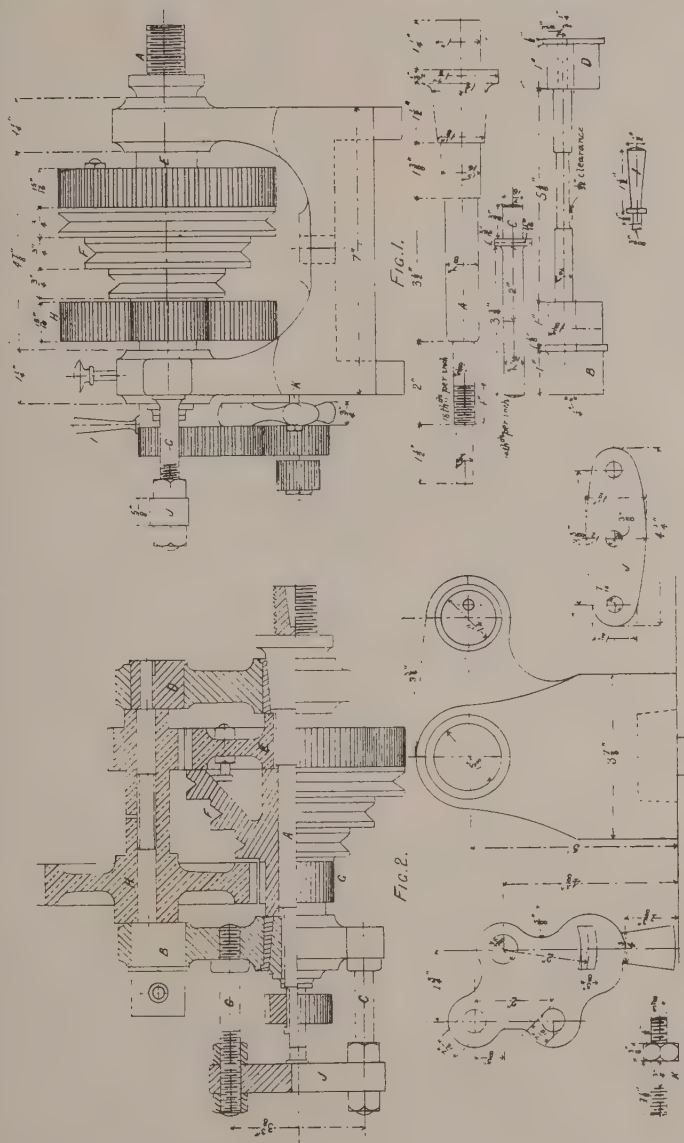


FIG. 3.

FIG. 4.

HOW TO MAKE A FIVE-INCH SCREW CUTTING LATHE.
Detail Drawings of Fast Headstock.

Scale: 3 inches = 1 foot.

The Editor's Page.

TO our readers, one and all, we extend the Season's hearty greetings, and right good wishes for prosperity in 1899. At the time of writing these notes, some days before Christmas, we have already received letters from readers containing similar intimations towards ourselves, and for these kindly thoughts we express our sincere appreciation.

In the current issue we commence the promised interview with Messrs. Coates, and venture to hope that this, with the photographs we reproduce, will be found of more than usual interest. Next month we shall give some further illustrations of their models, together with fuller details as to the special features of construction. In this issue we also commence the articles on making a screw-cutting lathe, and we hope in our next number to publish the first instalment of Mr. Avery's series on the design of small dynamos.

With regard to the possibility of arranging for provincial members of the Society of Model Engineers to benefit from their connection with the society, we are afraid that but little can be done unless a fair number of readers interest themselves in this matter. So far the responses to our invitation of last month for suggestions have been very few. Certainly not enough to warrant the circulating of a portfolio, as we had thought possible. Probably the most feasible method of providing for the needs of provincial members is in the direction of starting local branches of the society. Mr. H. E. Wilkinson, of Bexley Avenue, Leeds, has offered to take the initiative in forming a society for Leeds and district, and would be glad to hear from any readers of THE MODEL ENGINEER who would be disposed to join.

It is probably quite within the bounds of truth to say that the sun never sets on THE MODEL ENGINEER, for we now have subscribers in such diverse spots as America, Australia, China, and South Africa; but the very latest addition to our subscription book hails from a spot more off the beaten track we imagine than any we have hitherto received. It comes from Apià, in the Navigator Islands, and our correspondent writes as follows:

"I have no doubt you will be surprised to receive a subscription from this outlandish part of the globe, but No. 1, Vol. I., of THE MODEL ENGINEER drifted into my possession—from where I do not know. I am interested in electricity, but there is not an engineer or electrician in this country, so it is very hard to get information on such subjects. Your magazine will, I believe, be of great service to me. I have a launch which carries about 15 tons, with a 20 B.H.P. kerosene motor, of American make. I had never seen one before, but have managed to get it to go all right after about twelve months' trouble. It is fired with a small sparking dynamo, driven directly from

the flywheel. I had never seen a dynamo or battery before, and there was no person in the country who had knowledge of these things, so you can imagine what fun I have had."

As promised in our last issue, we have pleasure in announcing the following particulars of our

New Prize Competitions.

COMPETITION NO. 5.

A PRIZE OF £2 2s. is offered for the best article on

"HOW TO BUILD A MODEL SAILING YACHT."

The size and rig of the vessel are left to the competitor's own discretion, but the points to be taken into consideration are—firstly, speed; and secondly, soundness and simplicity of construction. The boat should not exceed 3 ft. 6 ins. in length, should be comparatively easy to build, and should not have any elaborate ornamental fittings. Complete drawings showing the lines of the hull, and the details of deck, rigging, &c., are necessary.

The closing date for this competition is February 28th. (See General Rules.)

COMPETITION NO. 6.

A PRIZE OF £2 2s. is offered for the best article on,

"HOW TO MAKE A MODEL ELECTRIC MOTOR CAR." This should be accompanied by complete working drawings, showing the construction of the body and wheels of the car, and also the details of the motor, accumulator, and gearing, etc.

The closing date for this competition is April 30th. (See General Rules.)

COMPETITION NO. 7.

TWO PRIZES OF £1 is. each are offered for the best descriptions of how to make a working model suitable for driving from a small steam or gas engine, or electric motor. The model described may be a miniature machine tool, crane, pump, agricultural machine, printing press, or any mechanical model with which the competitor is familiar. Full working drawings should accompany the description.

The closing date for this competition is June 30th. (See General Rules.)

GENERAL RULES.

The following rules apply to all of the foregoing competitions:—

(1.) Any reader may enter for each or all of the competitions, but each article, with its drawings, should be sent under separate cover, and should be marked on the outside with the number of the competition to which it belongs.

(2.) All articles should be clearly written on one side of the paper only, and should bear the full name and address of the sender.

(3.) All drawings should be made in Indian ink on white cardboard, and should show all necessary dimensions in plain figures. No coloured lines or washes should be put in. Each drawing should bear the full name and address of the sender on the back.

(4.) Competitors desiring their work returned, in the event of it being unsuccessful, should enclose stamps for that purpose.

(5.) The Editor reserves the right of printing any of the unsuccessful competitions which he may consider worthy of publication.

(6.) All competitions should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.

(7.) The Editor's decision must be considered as final.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a non-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.]

Model Loco Running.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In your issue of last November, I see a Mr. Alexander gives his experiences of model loco running, and criticises my remarks *re* same. Amongst other things, his experience shows him that the one rail must be level with its fellow in order to keep train on line. This is all right when a low speed and no curves are necessary. But, as I explained in my article, the outer rail of the curves are raised $\frac{3}{8}$ ins., otherwise an actual speed of six miles per hour round a curve of 35 in. radius would be impossible. Six miles per hour does not seem an excessive speed on paper, but I think, if your readers go into the matter, this is a very fair pace. The $2\frac{1}{2}$ in. gauge is about nineteen times smaller than the 4 ft. $8\frac{1}{2}$ in. gauge, so that, comparatively, the speed is 19×6 , which equals 114 miles per hour.

And again, take the case of cross-overs and switches: the outer rail of curve is necessarily higher, in order to balance the coach or loco over. This outer rail has to cross the inner one of the straight piece, and during this short distance it must fall from its raised position in order to cross the straight one at the same level. And this is what is done in actual practice on all our railways. Therefore, I still maintain that springs on all the wheels are necessary where the speed is high and on a track where there are many curves.

LEONARD JONES.

North Finchley.

Calibrating Voltmeters.

TO THE EDITOR OF *The Model Engineer*.

SIR,—In reference to "Voltmeter's" letter on the above subject, I should like to make a few remarks. He maintains that the two instruments, if of different resistance and sensibility, will give different readings; I do not see that this matters in the slightest. It is very improbable that in any particular case the amateur's voltmeter and the standard would give the same deflection for a certain P.D. as their terminals. He then proceeds to arrange the instruments in exactly the same manner as "Zodiac's," with the exception of a more convenient way of adjusting the P.D.'s applied to the terminals. All you have to do is to find a number of deflections on the instrument to be calibrated corresponding to the application of certain P.D.'s to the terminals, as measured by a standard voltmeter; it might be electrostatic and thus of infinite resistance.—I am, Sir, yours truly,

Surbiton.

"AMATEUR."

How to Convert an Ordinary Alarm Clock into an Electric Alarm.

TO THE EDITOR OF *The Model Engineer*.

SIR,—In making the following, one great advantage is, that it will cost nothing. Having procured the clock, slightly bend the bell hammer, so that when the alarm goes off, it will touch the bell and remain there, and not vibrate; the right distance the hammer should be from bell can only be found by experiment, generally $\frac{1}{4}$ in. or $3\text{--}16$ ths in. is sufficient; it will now be seen that when the alarm is set to go off, instead of the hammer vibrating, it will make contact with the bell, thus causing the electric

bell to ring; of course, the alarm must be wound up once and not afterwards. Connections are as follows:—Solder or screw a wire to the works of the clock and take it to the battery, another wire is put on under the screw of the clock bell, or soldered to it, and taken to electric bell; and another wire led from the other end of battery to the switch, and from there to electric bell. A box should be made to hold the battery, which should consist of two No. 2 Leclanché cells, and bell fixed on the end of it, with switch in the centre; the wires from connections on the block, should be brought to two small terminals, fixed at back of it, and the connections on the battery box done the same, then it will only require two wires to connect up. The box can be put at a little distance from the bed, and then the person will have to get out of bed to stop the alarm.—Yours truly,

Llanely.

"AMATEUR."

An Idea for a Spanner.

TO THE EDITOR OF *The Model Engineer*.

SIR,—The idea for a spanner mentioned in your December issue is old and bad. I got one by accident in a lot of other goods from an auction at Stevens. It is very weak across the jaw because the slide is cut out there, and the looseness of the jaw makes it very awkward to put on the nut. Also in confined places, the lost motion of the handle in closing up the jaw renders it inapplicable.—Yours truly,

Westcombe Park, S.E.

"WELL-WISHER."

Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A slinked addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, FARRINGTON AVENUE, LONDON, E.C.]
The following are selected from the queries which have been replied to during the past month:—

[500] **Electrical Education.** "ELECTRIC" (Loughborough) writes: (1) Please tell me the least expensive course of study in order to become a demonstrator in electrical science (at a college or technical school). (2) What books are there on electrical machine drawing or design?

To become a demonstrator in electrical science, as you will probably be aware, a long course of both practical and theoretical work is a *sine qua non*. The least expensive method will probably be a course of study (two or three years, according to age) at a good technical college, followed by an apprenticeship in an electrical works, the evenings still being devoted to theoretical study. With regard to the first item, you should inquire whether, and upon what conditions, scholarships are granted at your nearest technical institute, and then do your best to gain one for your particular study. As to apprenticeship, a small premium will be necessary, in all probability, or you may become an articulated pupil (extra advantages, of course), paying a premium of about £100 a year. Evening classes are cheap everywhere. Beyond this, it is difficult to indicate your movements. Probably you would easily get two or three years in a drawing office, when you would be well qualified to apply for the post you desire. Any good book on ordinary machine-drawing should be studied first, and the knowledge thus gained can be utilised in designing electrical machinery, when you are sufficiently advanced in the theoretical side of electricity.

[428] **Piston Valves—Boiler Queries.** "PISTON" (Lichfield) writes: (1) What are piston valves as used in lieu of slide valves for the admission of steam to cylinders—a rough sketch would oblige—(i) valves suitable for a double acting engine; (ii) valves suitable for single acting, trunk piston engine. (2) I have made a copper marine boiler, 12 ins. by 7 ins. by $5\frac{1}{2}$ ins. (oval shape), inner firebox 6 ins. long by $4\frac{1}{2}$ ins. by $3\frac{1}{4}$ ins., 6 tubes ($\frac{3}{4}$ -in. bore) leading to smokebox, copper 3 32nd-in. thick. All end plates are slightly flanged, and all is heavily brazed together. I wanted this boiler for 40 lb. working pressure. There are no stays or rivets. I suppose it will carry this, but at present I cannot get a fire (charcoal) hot enough even by blowing with bellows, and as soon as I get a few pounds of steam and turn a small blower on the blower uses all the available steam. Would a methylated spirit lamp be better, or could you suggest any alterations to boiler? I see other correspondents of your paper have made successful boilers with fireboxes no larger than this. Should I hold more steam by wrapping the boiler in flannel? (3) Referring to last query, could not a self-acting blow lamp (benzoline) be made for model boilers, with several burners?—the ordinary painter's blow lamp is such an awkward shape, costs a lot, and the heat is too local. An article in your paper would, I am sure, be of benefit to many readers, if you could devise some lamp instead of the "messy" charcoal.

(1) Piston valves consist of two pistons connected together by a central tube, like a dumb-bell, working in a circular valve chamber. They are employed when it is desirable to relieve the valve gear of the strains put upon it in driving unbalanced slide valves. The steam ports may be placed nearer to ends of cylinder, making a more direct passage. Steam is often admitted to the

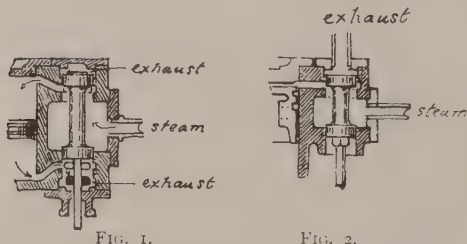


FIG. 1.

FIG. 2.

centre of valve between the two pistons, the exhaust taking place at the ends. (i) Valve for double-acting engine shown by Fig. 1; (ii) Valve for single-acting engine shown by Fig. 2. (2) Stays should be put across the $5\frac{1}{2}$ ins. width, and from end to end above firebox and tubes. The inside firebox should be stayed to boiler shell. These may be of $\frac{1}{8}$ in. or 5 32nd in. brass wire. There should be no difficulty in getting plenty of steam from a charcoal fire, provided the grate is about 1 in. above bottom of firebox, the fire door fitting well, and that when the steam blower is turned on air is drawn in under the grate and through fire and not through joints in smokebox. The grate should also fit close up to a bridge fitting the lower portion of firebox and about 1 in. back from tubes. Hard brittle charcoal is the best. (3) See letter from the Bickford Burners Company in August No.

[505] **Model Yacht Building.** H. S. (Regent Street) writes: I am about to start to build a model yacht *smooth build*. (1) What wood do you recommend, and is there any special way of bending it? (2) The boat is to be 30 ins. long; how many ribs would you

propose? (3) Please will you give me a few hints as to building?

An excellent material for building a model yacht is to be found in the thin sheets of pine used for backing pictures. It can be obtained readily in good lengths and has the advantage of cheapness. The wood must be planed on one side and strips cut $\frac{1}{2}$ in. wide. Reject all knotty pieces, or there will be trouble when building. There is no need to bend the strips previous to fitting them, as they are extremely flexible. The ribs should be about 3 ins. apart. In building a model of this description, the keel, stem and stern posts should be cut out of one piece of wood—preferably oak, about 5-16ths in. thick. The "ribs" are cut from any tough wood about the same thickness and made to fit over the wooden keel, pieces being also cut from the solid "rib" (more like a bulkhead) to lighten it. Of course, you will understand that the ribs are all cut in a proper proportion to get the "lines." The planks (the aforesaid strips, to wit) are then nailed to the ribs with thin brass nails, a couple of small brass screws being used to secure each end. Begin building from the keel upwards and on both sides. Sand-paper and scraping will make the outside neat when finished, and the joints should be caulked with a mixture of gold-size and whiting well rubbed in. A lead keel and deck of white pine complete the hull proper.

[515] **Cells for Coil Working.** H. R. writes: I have a coil about $3\frac{1}{2}$ ins. long, belonging to what is known as a "spamer coil," and which I wished to work with a few Leclanché cells made by Schall, Wigmore Street, and which are $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by $5\frac{1}{2}$ ins. I tried three of these, and then twenty-five, but got no appreciable current with either set, only a vibration of the hammer. I then tried a large dry cell (Obach's O size, 3 ins. by 3 ins. by $6\frac{1}{2}$ ins.), and with this one cell I got all the current one could desire. What I want to know is, why did the large number of Leclanché's fail to give a current through the coil? Is it not possible to get a current from such small Leclanché cells for this coil (used by me in medical practice)? I may say the small Leclanché cells are *wet* ones, and give quite sufficient current as a galvanic battery—in fact, I use them every day and get good results. Dry cells are too expensive and bichromates too messy. (2) I should be glad to know the composition of the black cement used for capping the top of cells?

(1) The reason why the small Leclanché cells did not work the coil is because the internal resistance of these is so high that not sufficient current can pass. Increasing the number of cells in series increases the voltages, but also increases the resistances in like proportion. The large Obach has a very low internal resistance, and consequently sends a sufficiently large current. You can get a good E.C.C. dry cell, or one of the "Carbone" cells for 3s., that will do all you require. (2) Pitch.

[522] **Loco Queries.** E. T. H. (Crewe) writes: (1) Could a 1-in., $1\frac{1}{2}$ -in., or 2-in. scale model of London and North Western Railway compounds "Jeanie Deans" or "Greater Britain" be reasonably expected to work? (2) Is there any means of raising powerful blast for same?

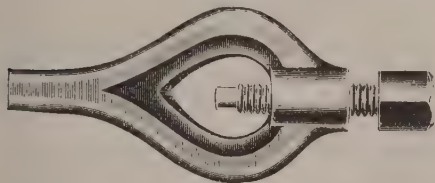
(1) A model of either engine to any of the scales would work; the larger scale model would, of course, do better than the smaller. It would be necessary to reduce the diameter of cylinders slightly. The boiler should have from ten to twelve tubes $\frac{3}{8}$ in. diameter for the 1-in. scale, and 1 in. diameter for the 2 in. scale model. (2) The engine could be fitted with the usual steam blower, and the exhaust steam from low pressure cylinder being discharged up chimney should give sufficient blast when engine is running. The boiler should be constructed to work at as high a pressure as possible, say, 60 lbs. to 70 lbs. per square inch.

Amateurs' Supplies.

[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.]

Workshop Requisites.

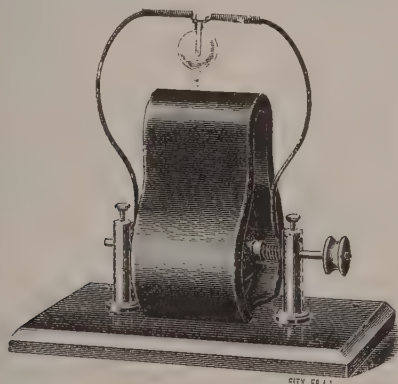
We have received from Mr. T. W. Meakin, of Sunner Road, Peckham, London, S.E., his new catalogue of engineers tools, &c., and also a sample of the drop-forged steel lathe dogs or carriers, of which he makes a speciality. One of these is shown in the adjoining illustration, the



special points claimed being strength combined with lightness, and neatness of construction. These dogs are fitted with steel screws, hardened at the points to prevent burring, and, judging by the sample before us, are turned out in very good style. The sizes range from $\frac{1}{2}$ in. up to $3\frac{1}{8}$ in. Other specialities in the list include different patterns of dogs, steel clamps, spanners, four-jaw chucks, surface-plates, beil-chucks, chasers, slide-rest tools, etc.

The "Dynolite" Model Dynamo.

The little dynamo shown below should appeal to many of our readers who are in possession of a model engine and are seeking something suitable for it to work. It will be seen from the illustration that the dynamo is fitted with a small incandescent lamp, which when the armature



is rotated at a good speed, gives quite a brilliant light. The dynamo is mounted on a polished wood base, and has lacquered brass bearings and terminals. It is supplied complete, including lamp and mountings, for 8s. 6d., or post free, 9s., by Messrs. J. T. Mayfield & Co., 41, Queen Victoria Street, London, E.C.

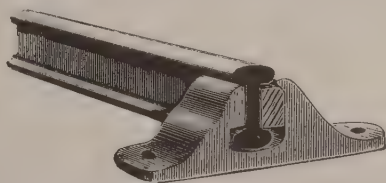
Model Engine and Motor Parts.

We have received from Mr. F. Thomassin, of 24, The Broadway, Streatham, S.W., some sample sets of castings and parts of model steam engines and of electric motors. The smaller steam engine castings are all in

brass, and are very cleanly turned out. In one of the sets we notice that the steam chest is made in two parts, the cover being separate from the body, thus allowing ready access to the slide valve. A sample of a 2-in. bore cylinder casting in iron is also sent, which is ready bored, and has the flanges faced and turned. The boring is particularly smooth. The "Little Hustler" set of electric motor parts is a very attractive and inexpensive line. This includes castings, wire, screws, brushes, bearings, commutator, and every detail for making a neat tri-polar motor, the whole of the mechanical fitting and turning being done, so that no tools but a screw-driver and pair of pliers are required to complete the model. The set is packed in a box, and includes full printed instructions how to set to work. We have also received samples of some extremely well made boiler fittings, such as water-gauges, steam taps, safety valves, &c. Mr. Thomassin's abridged list can be had post free for 1d. stamp, or the complete list, covering 56 pages, for 4d.

Model Railway Track.

Somewhat of a novelty in tracks for model railways is being introduced by Mr. H. O. Drake of 35, Heath Street, Hampstead. The rails are of the standard double-headed section and are drawn from brass tubing, and are then keyed in cast-iron chairs in the usual way.



Although the rails are made from tubing, the drawing process turns them into practically solid rails, and they have the advantages of not rusting if left out of doors, and of being easily tapered off where points are necessary. We illustrate a section of one of these rails, and from personal inspection can recommend them as well worth attention.

A Neat Switch-Board.

From Mr. Tambllyn-Watts, of Goldielands, Settle, Yorkshire, we have received the following particulars of a new switch-board which he has designed for lecture-table and experimental purposes. It is intended for use with primary batteries, accumulators, &c., and is suitable for x-ray work, cautery, electrolysis, and general laboratory use. It serves the same purposes as the more expensive double collectors which are on the market, is less liable to get out of order, and can carry much higher currents. By means of two collecting switches, any number of cells can be selected or any individual cell cut out. An instrument switch, at the top on the right, is provided for distributing current to the various pieces of apparatus in use, while there are sixteen terminals for connecting the leads from the different instruments on the lecture table (e.g., induction coil, Geissler tubes, Crookes tubes, &c.), so that there is no necessity to disconnect wires for the several experiments. A small link switch is fitted in the centre for an incandescent lamp which can be put on or off without interfering with current going to the other apparatus. Two of the terminals at the bottom are used for the wires from this lamp, which can be used as a reading lamp, if required. The other small switch is for cutting off the main current going through the collecting switches at any time. The bottom terminals are to be in connection with the battery leads, in this case for nine cells, with

eight spare terminals for additions at any future time. A photograph sent to us shows a board suitable for 15 amperes, the switches being mounted on enamelled slate bases, with insulated connecting leads enclosed at the back of the board. This switchboard can be modified to suit any special requirements, and the price varies accordingly. Mr. Tamblin Watts will be pleased to send particulars of this and other electrical and mechanical apparatus on application.

Catalogues Received.

W. MARTIN & Co., East Road, West Ham, London, E.—The eighth edition of Messrs. Martin's catalogue, besides particulars of the fine scale model locomotive castings and sets for which this firm are noted, contains new items in the way of shaping machines, "Albacore" cycles, and a triple expansion model marine engine. On page 4 there is an excellent photograph of a selection from the castings comprised in the set for making a scale model of a N. E. R. express loco. Altogether there are 222 castings in the complete set for this engine. We are informed that those amateurs wishing to make one of this firm's 2-in. scale locomotives, can obtain the castings if preferred in three instalments, thus making the monetary outlay more gradual and convenient. The shaper on page 17 is a strong compact machine, well adapted for dealing quickly with small work. It is arranged for either hand or power. The "Albacore" cycles which Messrs. Martin & Co. are now building, appear to be making a good impression. Lathes, tools, boiler fittings, and horizontal and vertical engines are also included in the list. Post free, 5d. Mailed free abroad.

DOLLOND & Co., 35, Ludgate Hill, London, E.C.—The electrical list issued by this old-established firm is very complete, covering 116 pages. It deals with influence machines, experimental sets, magnets, galvanometers, measuring instruments, compasses, small dynamos and motors, batteries and parts, accumulators, portable electric lamps, induction coils, vacuum tubes, incandescent lamps, medical coils and sets, bells, pushes, telephones, night lights, &c. The book is profusely illustrated. Post free, 6d.

WARD & GOLDSTONE, York Street Electric Works, Chorlton-on-Medlock, Manchester.—A useful list of wires for electric work is to hand from this firm. These include silk and cotton-covered wires for dynamos, motors, bells, instruments, &c.; twin wires for bells and telephones, silk flexible cords, multiple cables, gutta-percha wires, aerial conductors, electric light wires, fuse wires, and jointing materials. Post free on application.

THE CLYDE MODEL DOCKYARD, Argyll Arcade, Glasgow.—In an interesting list of latest winter novelties from this firm we find small electric motors, fans, dynamos, batteries, coils, magnifiers, model engines, and model yachts. A new large list for 1899 is nearly ready, which will deal very fully with mechanical and electrical specialities of all kinds, and also with Clyde-built model yachts, of which this firm turn out large numbers each year. We understand that they will supply scale models of the new yacht, "Shamrock," as soon as the design is made known. Readers should certainly obtain these lists. Post free, 4d.

G. BOWRON, 57, Edgware Road, London, W.—Readers who want bargains in the way of second-hand high-class electrical apparatus should send a stamp to Mr. Bowron for the list of his stock now on hand. This contains about 400 lots of electrical and mechanical apparatus and tools of every description, mostly by well-known makers. These goods include dynamos, motors, batteries, coils, electric light fittings, instruments, tele-

phones, telegraph apparatus, bells, lathes, gas engines, gauges, &c., and in many cases the prices are really low.

ATKINSON & Co., Harehills Avenue, Leeds.—From Messrs. Atkinson & Co. we have received some circulars descriptive of their improved "Simplex" typewriter, which appears to be an ingenious little machine. This has eighty-four characters, and the writing is "visible," i.e., it is always in sight while in progress. The type is inked from pads, and prints direct on to the paper. The machine is simple to operate, and produces very neat writing. The price is only 14s. 6d. The illustrated lists may be had, post free, on application.

HORNE & THORNTON, 416, Strand, London, W.C. In connection with their electrical department this firm issue a useful little list of small motors, dynamos, lamps, bells, batteries, coils, &c. They also send us a descriptive circular relating to the Cox thermo-electric generator, which is a device for producing an electric current direct from heat. Both lists, post free, on application.

W. H. ASTBURY, Machine Tool Maker, Grantham.—Mr. Astbury has sent us some illustrated sheets descriptive of his specialities in light engineering tools. Sheet No. 3, which deals with a new pattern of 4-inch lathe for model and electrical apparatus makers, should interest many of our readers. Post free, on application.

C. L. FORD, Market Street, Stalybridge.—The 1899 list of "Ford" accumulators and electrical sundries is just to hand. This gives particulars of a variety of small accumulators, lamps, scarf-pins, charging dynamos, water motors, &c. We have also received a list of several types of acetylene cycle lamps, of which goods Mr. Ford makes a special feature. Both lists, post free, for penny stamp.

D. F. LAING & Co., 47, South Portland Street, Glasgow.—This firm send us their special price list of sal ammoniac for batteries, which is supplied in standard charges put up in strong boxes. They have also sent us a large illustrated sheet of electrical specialities which they are just issuing, and some particulars relating to their new jointless system of electric bell wiring.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 3s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All correspondence relating to advertisements to be addressed to the ADVERTISEMENT MANAGER, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

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FEBRUARY, 1899.

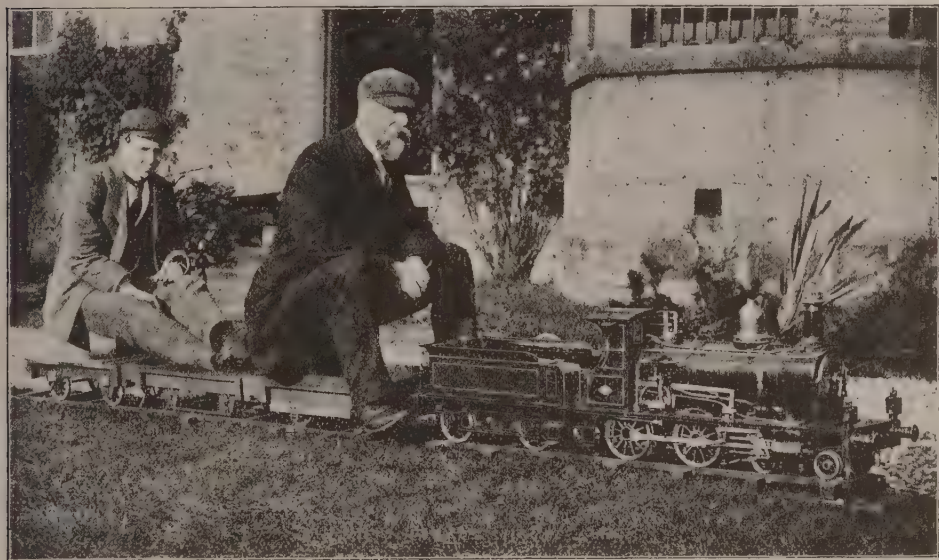
PUBLISHED
MONTHLY.

A Powerful Model Loco.

ONE of our readers, Mr. S. G. E. Copestake, of Glasgow, has kindly furnished us with the accompanying photographs and particulars of a model locomotive which he has recently completed. As the en-

struction, but it is made to work and perform some service. It took about two years of leisure hours to make.

The boiler is of copper, the work of a coppersmith, and cost £5. The driving wheels and frame were made at Messrs. Dubs & Co.'s locomotive works, Glasgow; all the rest was made at my small workshop at home; having only a 4-in. foot lathe, I could not manage the wheels.



MR. S. G. COPESTAKE'S MODEL LOCOMOTIVE WITH PASSENGER LOAD.

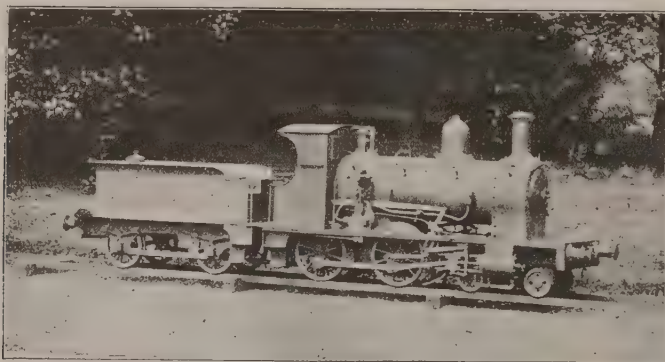
gine will pull a load of two persons along the level, it must be admitted that this is a powerful model for its size.

The locomotive is not a model of any particular engine, but is of original design; there is no novelty in its con-

The boiler has seventy-nine brass tubes, $\frac{3}{8}$ -in. outside diameter, as thin as possible, but thick enough to take a fine threaded screw at the firebox end. The flat surfaces are supported in the usual way by 140 screw copper stays,

3-16ths in. diameter; the firebox has the usual door and adjustable deflector plate. The boiler has the usual mountings:—Safety valve (double), glass gauge, gauge cocks, whistle, pressure gauge, steam brake and steam blower, and auxiliary pump cock, and two pump valves or clack boxes, also steam regulator and handle; there is no ash-pan. The boiler feed water is supplied from a pump worked by the engine when running, and an extra steam pump standing on the platform. The cylinders are outside, and valves on top, worked by an outside gear for the obvious reason of accessibility. The steam brake blocks acting on the four driving wheels are of hard wood. The boiler pressure is about 40 lb. per square inch, and the engine will take one person up one in ninety, and on the level, two, as shown in the photograph. The gauge between rails is 7 ins.

The tender, on four wheels, is supplied with a tank of stout tin, holding $2\frac{1}{2}$ gallons, a hand brake, and the usual bearing spring gear and feed cock.



ANOTHER VIEW OF MR. COPESTAKE'S MODEL.

Principal Dimensions.

Diameter of cylinders (brass)	1 $\frac{5}{8}$ in.
Stroke of pistons (brass, with steel rod)	2 $\frac{1}{4}$ "
Diameter of driving wheels (brass)	6 "
of bogie	2 $\frac{3}{4}$ "
Wheel base between driving wheels	9 "
" (total)	24 "
Thickness of frame (steel)	$\frac{3}{8}$ "
Height of platform from rail	5 $\frac{1}{2}$ "
Width of	11 $\frac{1}{2}$ "
Water in boiler	1 $\frac{1}{2}$ galls.
Diameter of boiler	6 $\frac{5}{8}$ in.
Length of boiler, including firebox	20 $\frac{1}{2}$ "
Heating surface, firebox	137 sq. in.
" " tubes	1,066 "
Grit area	40 "
Chimney diameter	1 $\frac{3}{4}$ in.
Thickness of boiler plates	$\frac{1}{16}$ "
Chimney, height from rail	18 $\frac{1}{2}$ "
Diameter of pump ran s (2)	$\frac{1}{16}$ "
Weight of engine in working order	145 lb.
Weight of tender	66 "
Extreme length of engine and tender over buffers	63 in.

The rails are of iron, $\frac{3}{4}$ in. deep by $\frac{1}{4}$ in. thick, fixed by wedges to pine sleepers $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. square and 12 in. long. The steam used is hard wood charcoal, and steam to a pressure of 40 lb. per square inch is raised from cold water in about half an hour.

Hints on Soft Soldering.

TINNING and soldering iron is a simple operation in itself, but from the hard work some mechanics make of it, it seems a hard undertaking for a beginner. The first step is to secure a clean bright surface upon the soldering tool; the worst of the dirt should be removed by filing while the tool is cold. A fine file should be used to finish the operation, for the marks left by a coarse file prevent a smooth tinned surface being obtained upon the copper bit. Some mechanics rub the tool upon sandpaper or emery cloth to remove the dirt and rust. This is a very good method, as sandpaper is much cheaper than files. After a bright surface has been obtained, heat the tool until just hot enough to melt the solder. The degree of heat may be closely estimated by holding the tool 1 in. from the cheek; this is the method usually employed by plumbers and tinner. As soon as the tool is heated a film of oxide will be formed upon the

surface, and it must be removed before the solder will adhere. To remove the oxide, and at the same time coat the tool with tin, procure a soft-burned brick, place some resin on the top thereof, melt it down with a soldering tool, and then melt in some solder with the resin. Great care must be taken to have the tool at as low a heat as will melt the solder, for if it is too hot the resin will be vapourised and driven off. The solder will not adhere to the tool as well when the latter is heated to a high temperature as when it is at the degree of heat above mentioned. All the conditions required being present, rub the soldering copper back and forth through the molten resin and solder. The brick will polish the tool, the resin flux the bright surface to prevent further oxidation, and the solder will adhere to the tool, giving it the coat of tin desired. When two coppers are to be tinned, they may be treated together, and rubbed back and forth in the melted resin and solder, at the same time being rubbed against each other. Some plumbers prefer to have a cavity in the top of the brick to hold the melted mixture. Such a cavity will naturally appear owing to the wearing action of the tool; but in using a new brick it is well to cut out a narrow hole in the top thereof by means of a cold chisel. Considerable of the dust made by the cutting of the brick may be left in the hole when the resin is melted in. Never use acid when tinning a tool; it is useless, as resin answers all the purposes. Sal-ammoniac may be used if desired, as that substance is the natural flux for copper.—*Engineer and Iron Trades Advertiser.*

The A.B.C. of Dynamo Design.

By ALFRED H. AVERY, A.Inst.E.E.

GIVEN the necessary tools and material, also a slight acquaintance with matters electrical, the amateur is sometimes stricken with a desire to construct a dynamo. But the problem at once faces him—What will be the correct dimensions to give to the individual parts; what are the considerations which influence their design; and, above all, what will the machine do when finished?

The reader's knowledge is probably limited to the simple fact that a dynamo is an instrument for converting mechanical into electrical energy. How many of those who build small dynamos for amusement and instruction can determine beforehand with any degree of certainty the proportions which must be given to the several parts in order to secure a given output at a given speed? Do

they endeavour to apply any rule other than the "rule of thumb," or the dictates of previous experience? Experience, indeed, should be the ultimate guide, but there are theoretical laws governing the design of the different parts in order that they may perform their several functions with the greatest economy, and if we want an efficient and reliable machine these laws may not be set aside. It is to the study of these laws and the principles underlying the construction and design of small dynamos, such as are within the range of the amateur, that the present chapters are devoted.

The essential parts of a dynamo, from an electrical point of view, are:

(a) The *armature*, which is somewhat equivalent to the cylinder in a steam engine;

(b) the *field-magnet*, which bears almost the same relation to the armature as the boiler to the steam cylinder;

(c) the *commutator*, which "commutes" the alternations of electrical energy generated in the armature into one direction; and

(d) the *brushes*, which serve the purpose of collecting this rectified energy and carrying it to some point where it may be convenient of access. The particular function of each of these individual parts, and the peculiarities of design which each demands, will be fully considered in the following chapters.

Mechanical details are of scarcely less importance, and will also receive due attention. They may be briefly summed up under the headings:

- (1) *Speed and rigidity*;
- (2) *correct design of bearings*;
- (3) *lubrication*; and
- (4) *provision for adjustment*.

Although, as will be shown hereafter, it is not possible to construct a very small dynamo which shall be an exact model and counterpart of a much larger one, the elementary theory of action and reaction which takes place in either machine is precisely similar; and this

will first be briefly explained before considering the modifications which may have to be introduced in practice.

It is necessary to have a clear conception of the nature of the "magnetic field" surrounding any magnet, as these imaginary lines of force form the most important basis of dynamo design. If a straight bar magnet (Fig. 1) be laid flat on a table with a sheet of white paper over it, fine iron filings sprinkled evenly on the surface, and the paper gently tapped, the filings will arrange themselves in such a manner as to indicate the direction of these lines of force. Every magnet—whether strong or weak, permanent or electrically-excited—has this invisible field, and the *whole* of the space surrounding it is filled with magnetic force, not merely in one plane, but in every conceivable direction. This will be made obvious by re-arranging the paper, placing it this time over the end of the magnet in a vertical position, and sprinkling with filings as before. The lines will now be seen to radiate from the pole in all

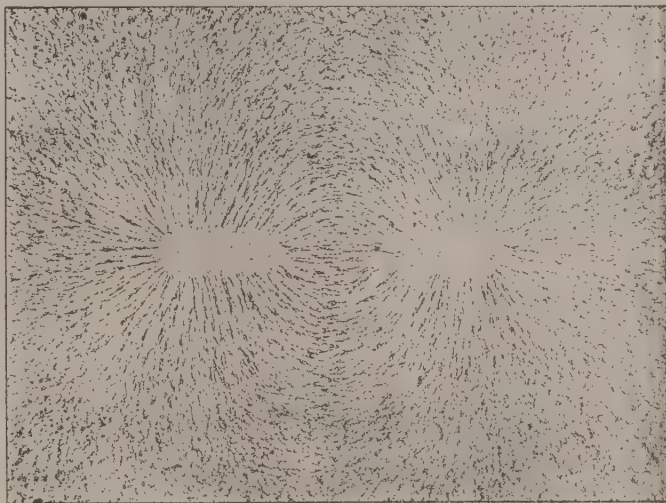


FIG. 1.

directions (Fig. 2). In reality there are no actual "lines" of force, for, unless they were infinite in number, there must be spaces between the lines destitute of magnetism. This can be clearly proved by rotating the magnet in Fig. 2 round its own axis; it will be found that no displacement of the lines occurs, whereas if they were finite, and their position dependent accordingly on the magnet pole itself, they would be bound to follow it in its rotation.

The only conclusion which can be arrived at, therefore, is that the number of so-called lines of force must be infinite, and quite independent of the degree of magnetisation. But, as it is obviously impossible to express measurements in terms of infinity, by common consent an arbitrary value of one line per unit area has been generally adopted as a practical measure of unit magnetic flux. This, however, should always be regarded in the light of a number or measure denoting *intensity of field*, rather than quantity of lines.

With such elementary knowledge of the nature of this magnetic field inseparable from every magnet,

we are now in a position to consider in what way this property of the magnet may be turned to account in the dynamo.

Faraday's discovery of "induction," which originated in 1831 the first machine that had any right to be called

$H \times V$. That is to say, the rate of motion must be varied if in a constant field, or the conductor may be moved at a uniform rate in a variable field. Uniform motion in a uniform field cannot produce electromotive force.

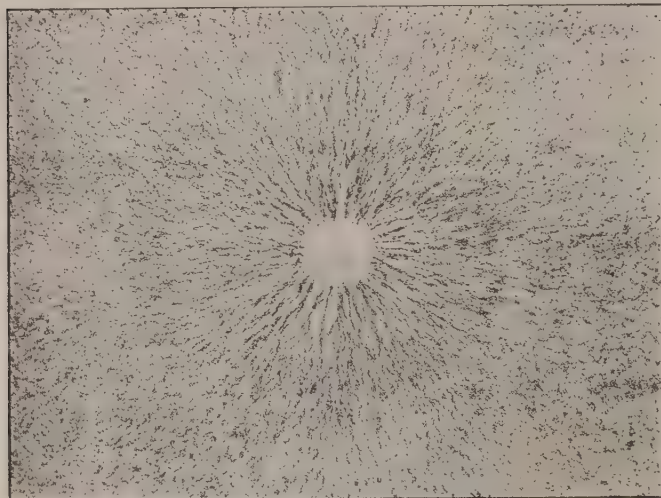


FIG. 2.

a dynamo, may be expressed as follows: If motion be imparted to a conductor when under the influence of a magnetic field, an electromotive force is "induced" or

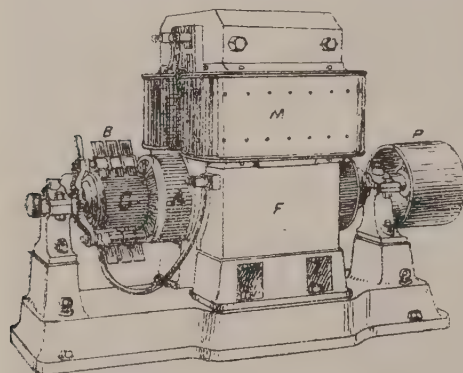


FIG. 3.—(A) Armature; (B) Brushes; (C) Commutator; (F) Field Magnets; (M) Field Magnet Coils; (P) Pulley.

set up in that conductor, and if the circuit be completed a current will flow. Calling the magnetic field H , and the motion of the conductor V , this law of magnetic induction holds good only when the conditions are such as to give a constant variation in the value of

form of a cylindrical core, on the surface of which the conductors are arranged, the whole rotating between the concave poles of a massive electro-magnet closely embracing it. The general disposition of the various parts can be clearly distinguished by referring to Fig. 3, which represents one of the splendid machines built by the Brush Electrical Engineering Company.

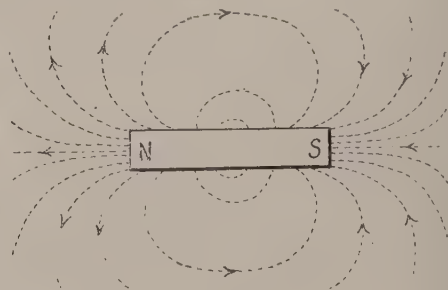


FIG. 4.

When a conductor moves in a magnetic field the direction of the induced E.M.F.* set up in it will depend both upon the direction of the flux and of the motion. It is generally conceded, although this also is quite an arbitrary decision, that the magnetic flux or flow of imaginary lines of force, leaves the magnet at its north pole, and

* Electro-Motive-Force.

re-enters at the south pole. The direction of the field at any point of a bar magnet is indicated by the arrowheads in Fig. 4. Fig. 5 shows the shape the "pole pieces" of the dynamo field magnet usually takes, and if N. and S. stand for its north and south poles respectively, then the direction of the magnetic flux through the armature A is shown by the arrowheads. As previously explained, the surface of the armature core A is overwound with numerous conductors wherein the E.M.F. is to be generated when rotating in the field provided by N.S. Let *c* represent any one of the armature conductors,

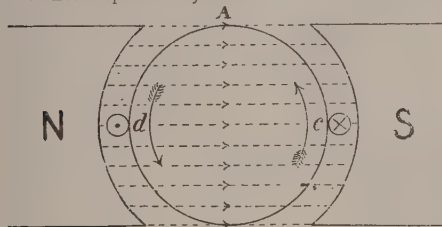


FIG. 5.

and its motion be (as shown by the curved arrow) in a direction contrary to that of the hands of a clock—i.e., "counter-clockwise." Now, the direction of the induced E.M.F. in that conductor can be determined by applying the following rule, which is due to Dr. Fleming, and one of the easiest to remember amongst a multitude of such:—Hold the first and second fingers and thumb of the right hand, so as to represent as nearly as possible three directions at right angles to one another, such as are made by the angles at the corner of a square box viewed from the inside (Fig. 6). Using the right hand always, turn or twist into such a position that the thumb points in the direction the conductor is moving, and the forefinger in the direc-

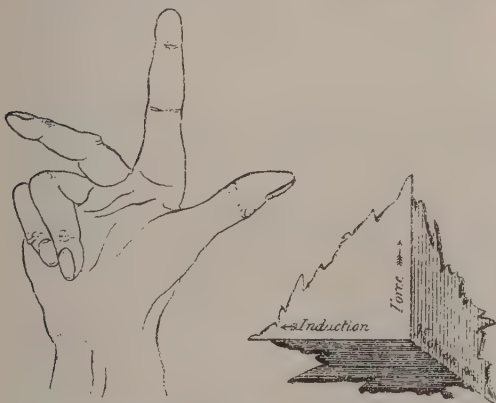


FIG. 6.

tion of the magnetic flux; then the middle finger will point the direction in which E.M.F. will be induced. The following associations should be made to fix this rule in the memory:

ThUMB = Motion.

FORE finger = Lines of FORCE.

SECOND finger = Direction of SECONDARY or induced E.M.F.

Thus in (Fig. 5) applying the above rule, there will be an E.M.F. induced in a downward direction, i.e., away from the observer; while in conductor *d* the same

rule applied will indicate the presence of an E.M.F. towards the observer. A graphic distinction in the direction of these E.M.F.'s is usually made by a small cross or dot in the section of the conductor, supposed to represent an arrow seen "end on," the dot being its point, coming towards the observer, and the cross its retreating tail.

There is one error to be guarded against, which the student is very likely to acquire. A dynamo does not generate an electric current; its action is similar to that of a pump. A pump raises water from a well, and so creates a difference of potential or level, enabling the water to do work in flowing back again; but it does not create water for all that. And so with the dynamo; what it does is to create a difference of electric potential between its terminals, by virtue of which a flow of current is enabled to take place. The dynamo should be regarded as an instrument for disturbing the hitherto perfect balance between the two great supplies of positive and negative potential existing in all space. The work done by virtue of this potential energy would appear to be simply the effort made by Nature to restore the lost equilibrium.

(To be continued.)

For the Book-shelf.

[Any book reviewed under this head as can be obtained from THE MODEL ENGINEER BOOK DEPOT, 60, FARRINGTON AVENUE, LONDON, E.C.5, by remitting the published price and cost of postage.]

THE ELECTRO-PLATERS' HANDBOOK. By G. E. BONNEY. London: Whittaker & Co., 2, White Hart Street, Paternoster Square. Third edition. Cloth bound. Price, 3s.

We have received a copy of the third edition of Mr. G. E. Bonney's book on electro-plating, a work which has already proved itself to be a thoroughly practical and reliable guide to the subject of the electrical-deposition of metals. The new edition has been brought thoroughly up-to-date by the revision of the chapter on dynamos for plating, and the addition of two sub-sections to Chapter VIII., dealing with nickel-plating cycle fittings, and nickelling small articles. Every department of electro-plating is fully dealt with, including plating by batteries and by dynamos; electro-platers' materials; preparing the work; making up the solution; plating with silver, gold, platinum, nickel, copper, zinc, iron, alloys, etc.; and there are numerous illustrations. The amateur or beginner in electro-plating cannot wish for a better instruction book.

CABINET-MAKING FOR AMATEURS. By JOHN P. ARKWRIGHT. London: L. Upcott Gill, 170, Strand, W.C. Cloth bound. Price, 2s. 6d.

The amateur with a kit of wood-working tools, and some slight knowledge of using them, will find in this excellent book instructions and designs sufficient to keep him going for many months to come. Indeed, if he be so minded, he can, from the information in this book, construct practically all the furniture required for a good-sized house, for the various chapters include how to make bookcases, tea tables, kitchen tables, house steps, plate racks, window boxes, washstands, bedroom suites, mantelpieces, dressing tables, chests of drawers, whatnots, umbrella stands, music stools, fire screens, writing tables, sideboards, wardrobes, and other items of woodware for domestic use, too numerous to mention. In addition there are instructions for making a hand camera, a garden swing, a folding jewel-case, a dog kennel, a butler's tray, and many other useful objects. The book, which contains 200 pages, is fully illustrated with designs and working drawings, and also gives some practical hints on tools and woods, and how to use them.

Model Engineers and Their Work.—II.

Messrs. T. and C. J. Coates.

(Continued from page 8.)

PASSING from personal matters to the equally interesting subject of the models which Messrs. Coates have made, we will first deal with what is probably their best-known piece of work—viz., the sec-

sure in the cylinders. Each piston rod is guided by a single-bar guide arranged vertically over it; in some of these engines the piston rod was extended through the cover as a tail rod.

The valve gear is of the usual shifting link construction, giving a cut-off varying from 75 per cent. with full gear to 17 per cent. in usual running condition; it is controlled from the foot-plate by a reversing screw. The regulator or main steam valve is of the vertical sliding type, and is arranged in a steam dome.

The boiler shell and the external firebox are of mild steel, but the internal firebox is of copper. The tubes are of brass, $1\frac{3}{4}$ in. outside diameter, and 240 in number. The grate area is 18 sq. ft., firebox surface 122 sq. ft., and tube surface 1,244 sq. ft. To ensure complete combustion the firebox is fitted with a brick arch and a deflector. The grate bars are of cast iron in two lengths. The blast pipe is of Mr. Adams' vortex construction, with an area of 14 sq. ft. The safety valves, loaded to 175 lb. per square inch, are of Ramsbottom's double type, with an easing lever extending to the cab. The feed water is supplied from the tender by two injectors, and the engine is fitted with a steam and an automatic brake.

The front of the engine is carried on a four-wheeled bogie, with wheels 46 in. diameter; the engine and bogie

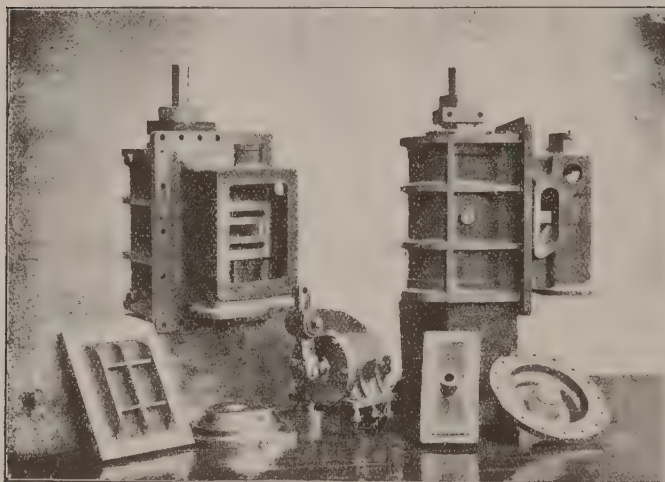


FIG. 5.—SOME OF THE CASTINGS FOR THE L. & S.W. RY. LOCO.

tional model of the London and South-Western Railway express locomotive, which is now to be seen in the South Kensington Museum. Our readers will remember that a photograph of this model was presented as a supplement with our last issue. As some indication of the immense amount of labour involved in producing such a model, we may here mention that Mr. Coates prepared no less than ninety-six sheets of scale drawings of the various details of this engine before taking up a tool to start the actual work of construction. Further than this, all the patterns were made in brass before any castings were obtained.

The model shows in elevation and section the details of the arrangement and construction of a modern express passenger locomotive, as designed in 1890 by Mr. W. Adams, and built at Nine Elms.

The cylinders of the real engine are 19 ins. diameter by 26 ins. stroke, and act on four coupled driving-wheels 35 in. diam., so exerting a tractive effort of 110 lb. per lb. of effective mean pres-

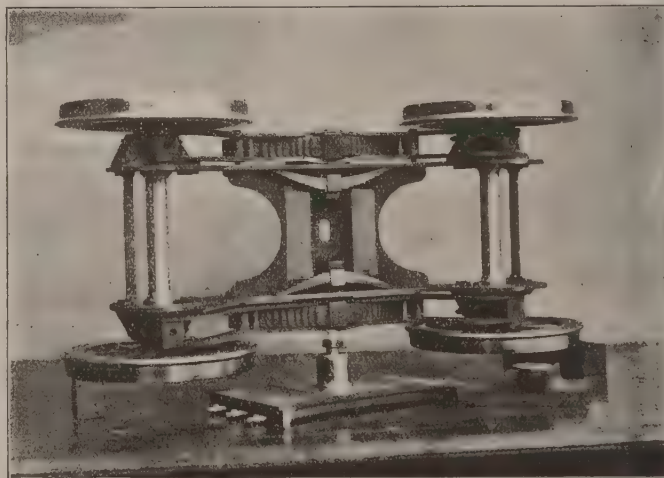


FIG. 6.—TOP OF BOGIE CARRIAGE FOR L. & S.W. RY. LOCO.

frames are of mild steel plate. The springs of the driving and trailing axles are connected by equalising evers. The total weight of the engine is 48·7 tons.

The model is to a scale of $\frac{1}{4}$ th full size, and took a year and nine months to make, the two brothers working on an average fourteen hours a day during this period. There are over 4000 rivets in the boiler, every one of which was turned in the lathe. The nuts are made from drawn hexagon steel wire; the drawing process being also done on the premises. The fact that this model was made in half-section added materially to the difficulty of constructing certain of the boiler details, a notable instance being the mounting for the safety valve, which proved very troublesome to hammer out to the correct shape. The section of the cylinder, it may be pointed out, is really made slightly above the centre line, in order to act as a guide to keep the piston in place when the model is shown at work.

The steam fire-engine shown in Fig. 1 in our last issue is a model of a double horizontal double-acting steam fire-engine, of the type made by Messrs. Merryweather. The scale of the model is $\frac{5}{24}$ ths full size, or $2\frac{1}{2}$ ins. to the foot.

This model shows the construction of a large modern steam fire-engine with horizontal cylinders such as is used on docks or other large areas of warehouse property. The machine is carried by large wheels on mail coach axles, with a forelocking carriage, and is generally arranged for rapid travelling, two horses being employed. The delivery hose is stored in the front box, and two lengths of heavy suction hose are carried, one on each side of the framing. Two coal bunkers on the footplate hold a supply of fuel, and the box seat is utilised as a tool store, and also holds a tank from which the boiler can be fed in case of emergency.

The pumping machinery consists of two horizontal steam cylinders, 7 ins. diameter, 7 ins. stroke, and two double-acting horizontal piston pumps, 5 ins. diameter. The steam pistons are directly connected with the water pistons by a common piston rod. The crank shaft is above the centre line of the cylinders and pumps, and is driven by a return connecting rod from a crosshead, which slides in guides fixed above the pumps, and is carried forwards and downwards to the piston rod. The suction and delivery valve chambers are directly below the pump barrels, and by removing a few bolts the valves are easily accessible. The delivery takes place above, two double sluice valves being arranged to direct the water into from one to four lengths of delivery hose. A large copper air vessel is placed on top of the delivery chamber, and a small one on the suction chamber to give a steady flow in the pipes, and a pressure gauge on the inside of the box above the pumps indicates the pressure in the hose.

Steam at 100 lb. pressure per square inch is supplied by a vertical boiler, very similar to that in the smaller engine, but having 76 sq. ft. of heating surface and 6 sq. ft. of grate area. The engine indicates 45 h.p., delivers 450 gallons per minute, and weighs about $1\frac{3}{4}$ tons. With a $1\frac{1}{2}$ -in. nozzle the jet reaches a height of 190 ft. Steam is raised to the full working pressure in ten minutes from the time of lighting the fire.

The model is in all respects a working machine, and the boiler, which is of copper, has eighty cross tubes, and has been tested to 300 lb. per square inch. It burns coal, and raises steam from cold water in ten minutes. The engine throws a continuous jet 2 in. diameter to a height of 75 ft. when running at 280 revs. per minute. The time taken to construct this model was twelve months.

Fig. 7 shows one view of a splendid model of a "Belleville" boiler, $\frac{1}{5}$ th full size, now to be seen in the South Kensington Museum. This model, which took twelve months to make, presented many features of un-

usual difficulty in construction, but it is perhaps needless for us to state that these were all successfully overcome, mainly by the very careful and systematic way in which Messrs. Coates tackled the work. As a preliminary portion of the task, about forty sheets of scale working drawings were carefully prepared from particulars kindly supplied by Messrs. Maudslay, Sons & Field, who have the rights for manufacturing these boilers in this country.

This form of boiler was developed and introduced by Messrs. Delaunay, Belleville, & Co., of St. Denis, France, but is now constructed in this country, and has been fitted

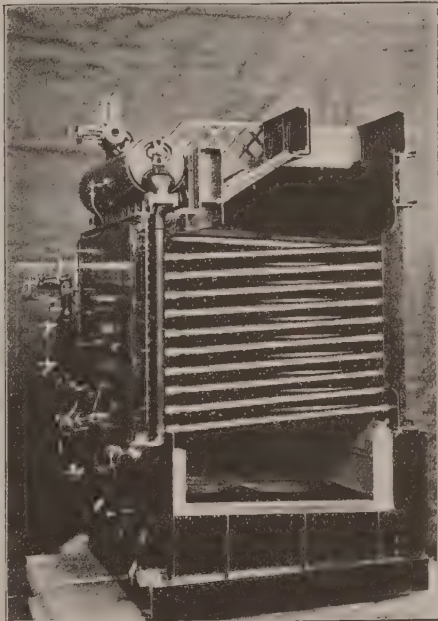


FIG. 7.—MODEL OF "BELLEVILLE" BOILER.

to some of the largest ships in the Royal Navy. In common with all water tube boilers, its construction permits of the use of very high pressures, and gives great steaming capacity in proportion to the space occupied. The Belleville boiler differs from others of this class in the details of its construction and arrangement, and also in the scale upon which it has been constructed; those on H.M.S. "Terrible" supply the whole of the steam for the 25,000 I.H.P. exerted by her engines, and there are other installations of similar extent. The model shows a complete boiler; but, as four boilers are usually built together, it only represents a fourth of the usual unit for marine work.

(To be continued.)

[NOTE.—In consequence of the large number of applications for estimates of models which Messrs. Coates have received since the appearance of our last issue, they ask us to emphasise the fact that they do not make any models at all—either for private or trade customers. They work exclusively for the authorities of the South Kensington Museum, and this being so their models can always be inspected by the general public, a privilege which would not exist if their handiwork passed into private collections.—Ed. M.E.]

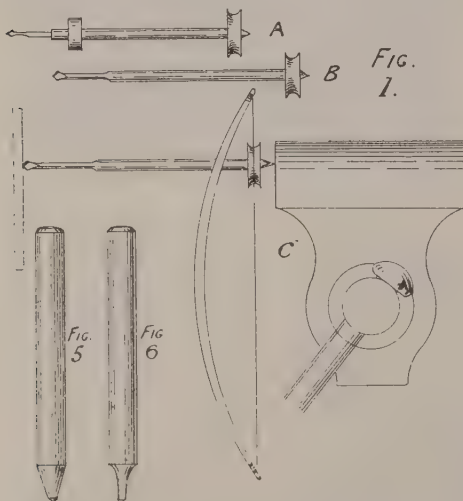
Making Small Tools for Model Work.

By F. J. G.

THESE papers are not intended to cover the whole range of tool making, but to instruct and help young amateurs to make such small drills, taps, etc., as they may want in the making of small models.

Drills will first be considered. In models holes are sometimes required to be made of almost hairlike fineness. Such holes obviously cannot be drilled either in a lathe or ordinary drilling machine, and the watchmakers' method has to be resorted to. His apparatus consists of a bow of thin cane or whalebone strung with cotton or very thin gut, and a drill holder with a ferrule affixed, round which the bow string is passed. These holders are generally used for very small drills. For larger ones, from 1-32nd. in. to $\frac{1}{8}$ in., several methods are employed. Sometimes a large holder, similar in all respects to the small one, is used, but usually each drill carries its own ferrule, and is complete in itself. This is the better way for home-made drills of this size, being more handy and rigid.

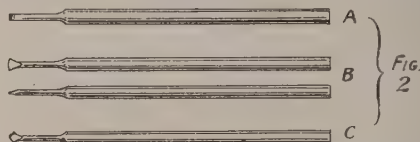
In Fig. 1, A is a drill holder. The drills are inserted and nipped tight by the small set-screw. It is rotated by the bow, the string of which makes one turn round the pulley-shaped ferrule. These holders can be purchased from tool dealers, and also drills to fit them, but as these are so easily broken, it is well for amateurs to be able to make them for themselves. B is a drill of larger size, carrying its own ferrule. C shows the way they are used: The drill or drill holder is held against the side of the bench vice, in which several centre punch marks have been made. The work to be drilled is held up to the drill by the left hand, the edge of the bench generally giving support and steadiness to the hand.



To make these drills the larger sizes will be taken in hand first. Suppose it is required to make a drill 1-16th in. diameter. Take a piece of steel rod of that size, or a little larger, and about 2 ins. long. The quality of this steel is important. The best steel is that bought in rods at tool shops, but in these small sizes knitting-needles do very well. Mild steel, such as is used for bicycle spokes,

etc., is of no use for drills. Having cut off the piece required, first make it thoroughly soft. This is done by heating it in a flame to a red heat and allowing it to cool slowly. It should be brought to a full red heat only, and not to a white, which is liable to spoil the steel.

Hold it in a hand-vice and reduce it by filing evenly all round to the shape shown at A in Fig. 2. The reduced portion should be a little less than the size of the required



drill. A handy rest during this filing is a piece of hard wood screwed in the vice, with a groove cut in its top surface, in which the drill can lie while being held in the hand-vice and filed. It now has to be hammered out flat at the end, as at B (Fig. 2), or "spread" as it is termed. For drills 1-16th in. and under this hammering can be done cold upon the vice jaws or a small polished anvil. Larger drills had better be heated to a full red heat and spread quickly while hot. A tap or two with a very light hammer should be sufficient. It must not be made too thin. The best proportion is that shown in the figures. Fig. 2 (C) shows the final shape to which the blade must be made. It will be seen that it cuts one way only. The back end of the drill must now be taken in hand. It must be tapered down slightly with a succession of flats, not being filed smooth and round, its end being pointed up to a nice centre.

The final process is the hardening and tempering. Fortunately for mechanics, steel is capable of being made extremely hard, quite soft, or almost any intermediate hardness at will. Hard steel—"dead hard," as it is sometimes called—is a little harder than glass and will cut it. Soft steel is about as hard as iron.

The simplest and probably the best hardening process is to heat to a red and plunge in cold water. This is the method recommended. Take the drill, now made, and heat its blade for about $\frac{1}{2}$ in. up, in a gas flame, to a good deep red, then very quickly dip it in cold water. When wiped dry, try it with a file; if it is hard, the file will slip over it without cutting. If it is still soft, try the hardening again, this time making it a little hotter. In this "dead hard" state it is very brittle, and would easily break in use. It must therefore be "tempered" a little.

"Tempering" is really a slow process of softening, by which intermediate degrees of hardness may be obtained. As hard steel is tempered, its brittleness gradually becomes less, its elasticity increases, and it becomes softer. When a piece of bright clean steel is heated, it first takes a pale straw tint, this deepens and turns to a deep straw, then to a red and from that to a deep full blue; as the heat is increased, this deep blue gets paler and finally disappears, at which stage the steel is again quite soft. The colours act as an accurate thermometer and tell the tool maker exactly when the steel is at the right heat for his special purpose. Thus, cutting tools for steel are made a pale straw colour; for brass a deep straw; and springs are tempered to a full blue, at which point the steel has its greatest elasticity and strength.

Take the drill and brighten the flat surfaces of the blades with a piece of emery cloth. Then hold it over a flame, not in the flame, and watch carefully for the first appearance of a pale straw tint on its surface. If for cutting steel, this is not enough; if for brass, let the straw colour become a little deeper. When right remove it and allow to cool.

(To be continued.)

The Slide Valve. Simply Explained.

By W. J. TENNANT.

(Continued from page 219, Vol. I.)

Lengthening or Shortening the Eccentric Rod—Shifting the Valve on its Spindle.—Starting with the valve in its central position, and lengthening or shortening the eccentric rod or shifting the valve on its spindle, or combining both operations in the same sense, the distance between the centre of the crank-shaft and the centre of the valve is altered, and the travel of the valve is shifted bodily to the right or left, *i.e.*, the valve when in the centre of its travel (the extent

be diminished by that amount, and that subsequently, at cut-off, release and compression, for both ends of the cylinder, the valve would always be found $\frac{1}{8}$ in. to the left of its proper position. The result would be as shown in Fig. 28, that:

At left-hand of cylinder (see lines of dashes):—

Lead decreases	} Earlier, these operations taking place as the valve moves towards the left.
Cut-off takes place	
Exhaust commences	
Compression commences later,	this operation taking place as the valve moves from the left.

At right-hand end of cylinder (see lines of dots):—

Lead increases	} Later, because when effecting Cut-off takes place Exhaust commences Compression commences earlier, for it occurs whilst the valve is moving to the left.
Cut-off takes place	
Exhaust commences	

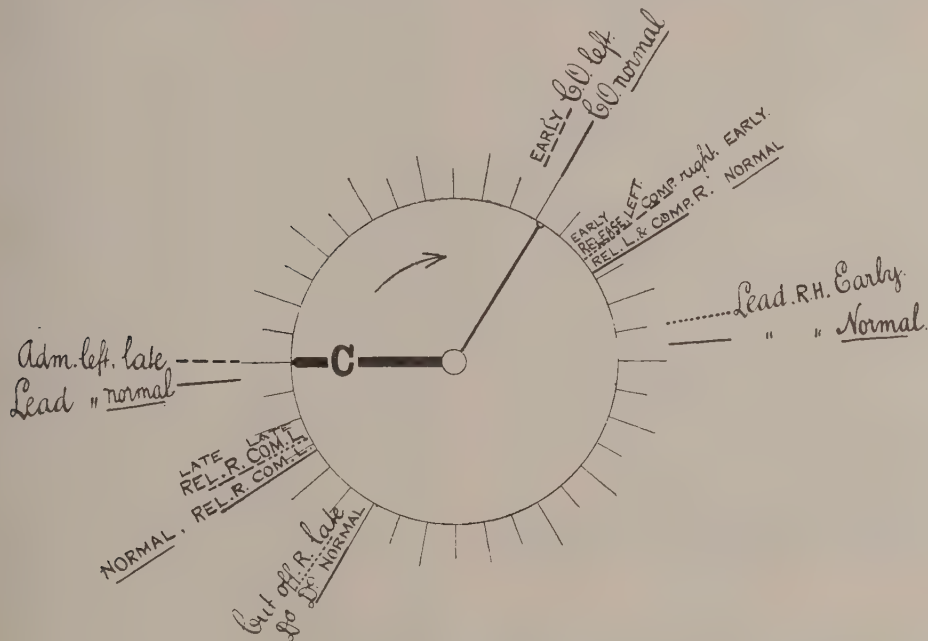


FIG. 28.

of travel remaining of course unaltered) will be either further from or nearer to the crank-shaft than before, while the position of the ports remains unaltered; therefore the arrow upon the valve at its centre (see Fig. 16 in the August issue) lies to the right or left of the centre line of the port-face, and that arrow being no longer appropriate as a pointer at mid travel to the zero of the scale on the ports, we must adopt as our index finger the graduation mark made adjacent to the arrow and lying over the said zero, in order that when the disc may indicate that the valve should move say from 0 to 6 the new mark or index-finger, and not the arrow, may be given that movement.

If the valve had previously been properly set for lead, and the alteration shifted it $\frac{1}{8}$ in. to the left, for example, we should find that the lead at the left hand end would

the alterations at opposite ends being in opposite sense. (The normal distribution is shown by *full lines* for comparison.) And although the commencement of the operations is completed and retarded by the same amount of error, operating in opposite sense on opposite sides of the piston, yet there is a difference in the work done upon the opposite sides because of the commencement of the two cycles of operation at different times, whence we infer differences in the speeds of the piston, in the quantities of steam admitted, and in the expansion curves.

In some cases such a difference is desirable, and with the working diagram suggested in the April issue, another series of results may be obtained by using the ordinary valve for distribution on one side of the piston, and for the other side using a differently-proportioned valve with a different index-pointer, as though opposite ends of one

value with regard to setting out Joy's valve gear may be found in an article contributed by Mr. Joy to the *Practical Engineer*, of December 7th, 1888.

The Link Motion.—In engines whose duty frequently

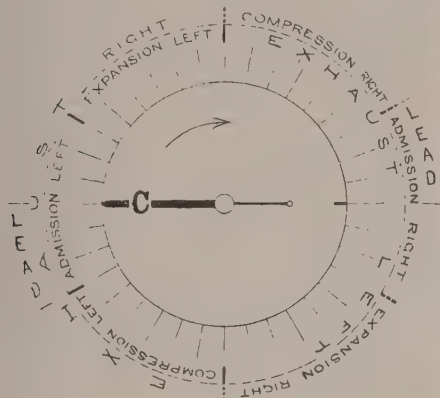


FIG. 30.

varies, as in the familiar case of a locomotive, permanent alteration of lap would not meet the requirements of the case, for the amount of expansion should be susceptible of ready variation at any time, in accordance with alterations in the weight of train, gradients, and weather. The link motion, in addition to being a reversing gear, is also a "variable expansion" gear. A precise analysis of any given case of link motion is a somewhat difficult operation, but, speaking broadly, the link motion may be said to provide what is virtually an eccentric of different throw and advance for each degree of expansion. Although, actually, the same two eccentrics remain constantly in use, the link motion may be so adjusted as to have an effect on the valve *similar to that which would ensue* upon the substitution, one for another, of different eccentrics as stated. Assuming that the lowest range of expansion is being used, the valve will have the travel, cut-off, and lead due for the most part to the throw of the actual eccentric and to its position with relation to the crank, almost as in the case of an eccentric whose rod is directly connected to the valve spindle; now, as the link is raised (an operation sometimes termed "linking-up") its centre gets nearer to the block on the end of the valve-spindle than it was before (*i.e.*, nearer to "mid-gear"), and we get in effect:—

With link motion having "open" rods. A series of eccentrics of decreasing throw, but of increasing angular and linear advance.

With link motion having "crossed" rods. A series of eccentrics of decreasing throw and of increasing angular, but decreasing linear advance; throw, therefore, decreasing more rapidly than in the case of the link motion with "open" rods.

(See Holmes's "Steam Engine" for further and more detailed information with regard to the link motion and valves and valve gears in general.)

Take the case of a partially linked up motion with open rods; we shall find that because the throw of the eccentric is lessened the travel of the valve to the right and left of its central position will be diminished and the

ports will not be opened so wide to steam or exhaust; because of the increased advance of the eccentric, steam will be cut off earlier, compression and lead will also be earlier, expansion and compression lasting longer, and exhaust and admission being shortened.

Below are diagrams showing the effect of putting the link-motion in "mid-gear" (Fig. 30) and of putting the link-motion into "back-gear" (Fig. 31) while the engine is running ahead, as for a locomotive, but it will be understood that the effect of the compression shown in the latter will be modified by the lifting of the valve from its face with the result that some compressed air and steam will go up the exhaust.

The set of diagrams forming Fig. 32 is intended to give a comparative view of the effect upon the distribution of steam, of differently arranged valves and eccentrics. The operations taking place upon only one side of the piston are shown, except in that section of the diagram

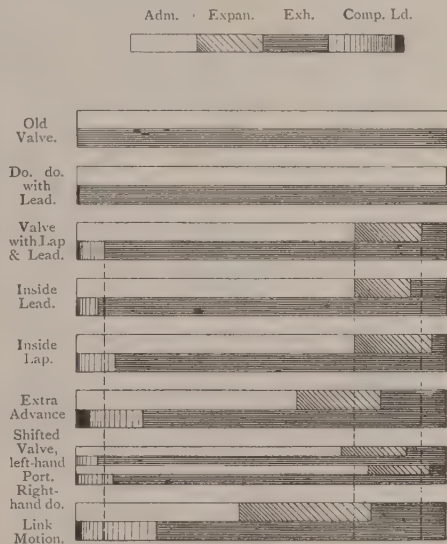


FIG. 32.

which concerns a shifted valve, in order to avoid confusion, the upper line of each diagram being read from left to right shows the operations which take place on the forward stroke, those of the return stroke being read from right to left upon the lower portion of each diagram.

FIG. 33 SHOWS ENLARGED KEY-VIEW OF CARDBOARD CRANK-DISC, WHICH SHOULD TURN WITH THE CIRCLE DRAWN IN THE CENTRE OF FIG. 1.

The arm marked C is the crank arm, and serves as an index finger in the recording and reading of results.

The mark 1 is the index mark for the forward eccentric operate a valve without lap.*

The mark 2 is the index for a forward eccentric set for lead, using a valve without lap.*

The mark 3 is for a forward eccentric for a valve with lap and lead run in "full gear."**

The mark 4 is for a forward eccentric for a valve with lap and lead run with a link-motion partially linked up.***

The Society of Model Engineers.

AT the meeting of the above society, held at the Memorial Hall, Farringdon Street, E.C., on Tuesday, January 3rd, about seventy members and friends were present. A number of interesting models, etc., were on view, and those present manifested great interest in the exhibits, amongst which the following deserve notice:

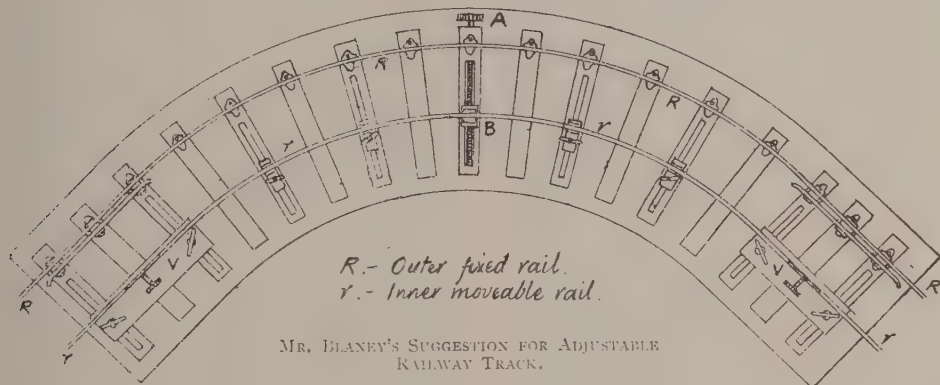
Mr. HERBERT HILDERSLEY exhibited a clever continuous motion drill-holder for working by hand. The drill was mounted in a shaft, which revolved freely in the holder. The revolving shaft was fitted with a coiled spring, which carried a pulley, upon which was wound a string. A flywheel was also fitted upon the shaft, and upon pulling the string, the shaft, with the drill, was caused to revolve. The flywheel carried on the motion of the drill, while the coiled spring wound up the cord ready for the next pull. The tool worked splendidly with small drills up to $\frac{1}{8}$ in.

Mr. E. L. PEARCE showed three sheets of coloured working drawings for a model locomotive, designed by himself with a view to adopting as many good features as possible from various standard engines.

screw passes through the prolongation of a chair which carries the rail, the sleeper being slotted to allow of the movement. As the gauge is narrowed, the ends of the curve rail are drawn away from the ends of the straight, and to prevent a gap being formed, the ends of both rails are halved for a short distance (V), and the joint supported by a long chair. A guard-rail on the outer curve prevents any danger of the engine leaving the track. The curves having been fixed, and the rails tested for gauge all along the curve, the chairs of the inner rail are clamped down to the sleepers by means of fly-nuts, and the track is ready. Mr. Blaney supplemented his description by adding that if model locomotives are to be as like the originals as possible, then the permanent way should be similarly treated.

Mr. TENNANT, who had previously suggested that a central rail with a guiding attachment to the models would meet all requirements, stated that he had been provided by Mr. Solomon with a better suggestion. It had been proposed to him to have, not a raised central rail, but a narrow channel, in which a guiding bogie might run, and this idea had been practically carried out for Mr. Monk White. The model of the suggested bogie was then handed round for inspection.

Mr. PEARCE suggested that three gauges be adopted



Mr. BOWLING exhibited and described an excellent model of a G.W.Ry. tender-locomotive. This was a four-coupled, inside-cylinder, bogie engine. Mr. Bowling pointed out that he had allowed a very considerable amount of side play in the bogie, with the result that the engine would run on a track having some very sharp curves.

The "A.W.M." dynamo, described and illustrated in the January number of THE MODEL ENGINEER, was also shown and attracted much attention, as did also an excellent and well finished model of a G.N.R. locomotive exhibited by Mr. Lowne.

Mr. PERCIVAL MARSHALL took the chair at 7.45, and after formal business had been disposed of, called upon Mr. W. Blaney to explain his adjustable railway track for model locomotives which had been constructed since the last meeting of the society. At that meeting, Mr. Blaney exhibited a model of the adjustable rail applied to a straight section, and it was acting on the request of several members that the model of a curve had been constructed. The arrangement is shown in the illustration, and consists of an outer fixed rail, and an inner movable one. This is adjustable at the middle of the curve, and is moved by a central screw with a milled head (A). The

as standard, and all future models constructed to either one or the other of them. He proposed $3\frac{1}{4}$ -in., $4\frac{1}{2}$ -in., and 7-in. gauges, as sufficient for most purposes.

Mr. CREBBIN said he still maintained that the right principle to go upon was for amateurs to build their engines on a "broad gauge" basis, so as to get room for larger boilers and space for motion.

Mr. SOLOMON did not think it possible to bind model-makers down to definite gauges.

The CHAIRMAN then proposed the following resolution: "That this society recommend that two gauges be adopted as standard by those members who are going to make models, and that a sub-committee be appointed to settle what the actual gauges should be."

This recommendation having been seconded by Mr. MONK WHITE, was put to the meeting and carried *unanimously*.

The following gentlemen were nominated for the sub-committee and agreed to: Messrs. M. White, Bowling, A. M. H. Solomon, Jas. C. Crebbin, and E. L. Pearce.

Before reading his paper on "Locomotives," Mr. TENNANT proposed a hearty vote of thanks to Messrs. W. Blaney and Monk White for taking so much trouble

in making the models for the locomotive track. The two gentlemen having replied in suitable terms, the meeting was put into darkness, and Mr. Tennant commenced a most interesting discourse on locomotives, which was illustrated by means of the optical lantern.

The lecture, which we regret would occupy too much space to permit its being printed here in full, traced the development of the locomotive from the early days of Trevethick and Stephenson down to the present time. Mr. Tennant's practical remarks and his crisp comments on the special features of interest in the various photographs shown on the screen, were much appreciated by the audience. The numerous slides had evidently been selected and prepared with great care, and several of them evoked considerable applause on making their appearance. The lantern was provided and operated in a very skillful manner by one of the members, Mr. R. J. Lowne, and his brother. To Mr. W. J. Tennant and to the latter two gentlemen a hearty vote of thanks was accorded for their valued contributions towards the evening's programme.

The meeting then terminated.

THE NEXT MEETING.

The next meeting of the society will take place at 7 o'clock on Wednesday, February 1st, at the Memorial Hall, Farringdon Street, E.C. An unusually large number of exhibits of models and apparatus have been promised for this occasion, and it is hoped that a number of experiments with electrical apparatus will be arranged. Mr. R. J. Lowne has consented to show an interesting vacuum engine, and to give a description of its construction and working; Mr. A. M. H. Solomon will exhibit and describe a simple model locomotive, which should be of interest to the junior members of the society; Mr. E. L. Pearce will show some experiments with an induction coil and vacuum tubes; and the other items promised include a model racing sailing yacht; a model torpedo-boat destroyer; an electric cycle lamp; some model donkey-pumps, &c.

THE LIBRARY.

It will be remembered that one of the original objects in forming the society was to inaugurate a library of technical books, which should be available for circulation amongst the members. The committee are glad to be able to announce that steps have been taken to put this scheme into practical operation. A book-case has been purchased to contain the books, and this will be kept at the publishing offices of *THE MODEL ENGINEER*, 6, Farringdon Avenue, E.C., where the books will be issued to those members who require to borrow them. Mr. F. E. Powell has been appointed by the committee to act as honorary librarian, and a set of rules regarding the issuing and return of the books is being prepared, and will be published in our next issue. We have pleasure in announcing that to assist in the formation of a useful collection of works of reference, the chairman of the society, Mr. Percival Marshall, has presented to the society the undermentioned books:—

MODEL ENGINE CONSTRUCTION. By J. Alexander.
WORKSHOP APPLIANCES. By C. P. B. Shelley.

FORTY LESSONS IN ENGINEERING WORKSHOP PRACTICE.

THE METAL TURNER'S HANDBOOK. By Paul N. Hasluck.

THE MODEL ENGINEER'S HANDBOOK. By Paul N. Hasluck.

TURNING FOR AMATEURS. By James Lukin, B.A.
ELECTRICAL EXPERIMENTS. By G. E. Bonney.

DYNAMOS AND MOTORS: How to Make and Run Them.

SMALL ACCUMULATORS: How Made and Used.

INDUCTION COILS. By G. E. Bonney.
ELECTRICAL INSTRUMENT MAKING FOR AMATEURS. By S. R. Bottone.

It is probable, that among the many members of the society, there are other gentlemen who are able and willing to help in a similar way, and offers of books which members may be able to spare, will be much appreciated by the committee.

Although the actual rules have not, at the time of writing, been definitely drawn up, it is intended that the books shall be issued for periods of not exceeding seven days, to London members, and for periods of not exceeding ten days to country members. Members can obtain the books they desire by applying to our publishers between the hours of 9 a.m. and 6 p.m., but must, in all cases, produce their membership card in proof of identity. No member will be permitted to have more than one book out at a time, and if several members require the same book it will be issued to each in turn in order of application. It is hoped that the books will be ready for issue by February 1st. All communications concerning the library should be addressed to the Hon. Librarian, Society of Model Engineers, 6, Farringdon Avenue, London, E.C.

FORMATION OF A LEEDS BRANCH.

We are pleased to be able to announce that a local branch of the society has been definitely started at Leeds. The first meeting was held at 51, Bexley Avenue, Roundhay Road, Leeds, on January 2nd, when Mr. H. E. Wilkinson was elected chairman and treasurer, and Mr. Wm. Miles Buckingham, 46, Bayswater Crescent, Roundhay Road, Leeds, was elected honorary secretary, and a set of rules was also drawn up and passed. Mr. Wilkinson exhibited a $\frac{1}{2}$ -inch scale model of a N. E. Ry. locomotive working under steam; several small boilers; a 2-h.p. beam engine; and a double cylinder marine engine. Subsequently to the meeting he gave several practical demonstrations as to the proper method of using a soldering iron to give the best results. The next meeting will be held at the same address on February 2nd, after which date it is proposed to hold the meetings somewhere near the centre of the city. A good number of local model-making enthusiasts have already joined this branch, and it appears to have a very promising future before it. Readers who wish to become members should communicate with Mr. Buckingham at the above address.

An instructive paper was read at the late meeting of the American Society of Mechanical Engineers by Mr. C. H. Benjamin, on "The Bursting of Small Cast Iron Flywheels." The author arrives at the following conclusions:—(1) Flywheels with solid rims, of the proportions usual among engine builders, and having the usual number of arms, have a sufficient factor of safety at a rim speed of 100 ft. per second, if the iron is of good quality and there are no serious cooling strains. In such wheels the bending due to centrifugal force is slight, and may safely be disregarded; (2) Rim joints midway between the arms are a serious defect, and reduce the factor of safety very materially. Such joints are as serious mistakes in design as would be a joint in the middle of a girder under a heavy load; (3) Joints made in the ordinary manner with internal flanges and bolts are probably the worst that could be devised for this purpose. Under the most favourable circumstances they have only about one-fourth the strength of the solid rim, and are particularly weak against bending. In several joints of this character on large flywheels, calculation has shown a strength less than one-fifth that of the rim. Several important American engine builders are said to have changed the design of their wheels lately by bringing the rim joints opposite the ends of the arms.

The Editor's Page.

A CORRESPONDENT, "E. B." (Wallington), is anxious to compare notes with other readers on the uses of a Wimshurst machine for x-Ray work. He writes:—"I have often seen it stated that the Wimshurst is superior to coil for x-Ray purposes. I find the Wimshurst answers very well for thin subjects, such as lizards, snakes, flat fish, or a hand, &c.; but for a thick subject, such as the thigh or body, it is practically useless. If you could give me the address of anyone who has had some experience in these matters, I should like to compare notes." We may, perhaps, mention that we shall shortly publish an article on this subject, but meanwhile shall be glad to hear the experiences of any of our readers who have been working in this direction.

"T. B." (Bruges, Belgium) in sending a subscription writes:—"I must tell you that I am delighted beyond measure with your journal. Living abroad excludes me from joining your delightful Society of Model Engineers; but later on, if I go to London, I shall certainly join."

"Ibex" (Guernsey) writes urging us to insert in THE MODEL ENGINEER occasional supplements dealing with photography in the same manner as we at present deal with mechanics and electricity. Our correspondent expresses the opinion that there is not a single paper altogether suitable for amateur photographers, and predicts a mad rush for our journal if we act upon his suggestion. Even were it true that there did not exist a really good photographic paper for amateurs, we feel that we should not be doing the right thing to incorporate so much matter in THE MODEL ENGINEER which would really be foreign to our proper sphere. We are inclined to believe that much of our success is due to keeping the journal exclusively devoted to mechanical and electrical matters, and it would not, we think, be a wise policy, nor yet be fair to our present readers, to trench upon other fields as "Ibex" would have us do. Apart from this determination on our part, however, we may mention that there are already several excellent photographic journals in existence which should amply satisfy our correspondent's wishes, and if he will drop a line to our publishers we have no doubt they will be very pleased to send him the fullest of particulars.

In the description of the trial of the "A. W. M." dynamo described in our last, a slight printers' error occurred, which made the figures somewhat misleading. The figures 3,600 should read 1,600. We have also to draw our readers' attention to an omission in the diagram, Fig. 9 on page 3. There should be a connection shown between the wire to "Zinc" terminal and the nearest "Bell" terminal, or, in other words, the two middle terminals at bottom of base board should be connected by a wire. We understand that several of our readers have constructed the telephone station, and, with this exception, have found the instructions quite clear.

Mr. W. W. Burtonwood, 47, Walnut Street, Hulme, Manchester, writes offering to help in the formation of a branch of the Society of Model Engineers for Manchester. Will readers in this district who are interested in the matter kindly communicate with our correspondent at the address given?

New Prize Competitions.

COMPETITION No. 5.

A PRIZE OF £2 2s. is offered for the best article on

"HOW TO BUILD A MODEL SAILING YACHT."

The size and rig of the vessel are left to the competitor's own discretion, but the points to be taken into consideration are—firstly, speed; and secondly, soundness and simplicity of construction. The boat should not exceed 3 ft. 6 ins. in length, should be comparatively easy to build, and should not have any elaborate ornamental fittings. Complete drawings, showing the lines of the hull, and the details of deck, rigging, &c., are necessary.

The closing date for this competition is February 28th. (*See General Rules.*)

COMPETITION No. 6.

A PRIZE OF £2 2s. is offered for the best article on

"HOW TO MAKE A MODEL ELECTRIC MOTOR CAR."

This should be accompanied by complete working drawings, showing the construction of the body and wheels of the car, and also the details of the motor, accumulator, and gearing, etc.

The closing date for this competition is April 30th. (*See General Rules.*)

COMPETITION No. 7.

TWO PRIZES OF £1 1s. each are offered for the best descriptions of how to make a working model suitable for driving from a small engine or gas engine, or electric motor. The model described may be a miniature machine tool, crane, pump, or agricultural machine, printing press, or any mechanical model with which the competitor is familiar. Full working drawings should accompany the description.

The closing date for this competition is June 30th. (*See General Rules.*)

GENERAL RULES.

The following rules apply to all of the foregoing competitions:—

(1.) Any reader may enter for each and all of the competitions, but each article, with its drawings, should be sent under separate cover, and should be marked on the outside with the number of the competition to which it belongs.

(2.) All articles should be clearly written on one side of the paper only, and should bear the full name and address of the sender.

(3.) All drawings should be made in Indian ink on white cardboard, and should show all necessary dimensions in plain figures. No coloured lines or washes should be put in. Each drawing should bear the full name and address of the sender on the back.

(4.) Competitors desiring their work returned, in the event of it being unsuccessful, should enclose stamps for that purpose.

(5.) The Editor reserves the right of printing any of the unsuccessful competitions which he may consider worthy of publication.

(6.) All competitions should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.

(7.) The Editor's decision must be considered as final.

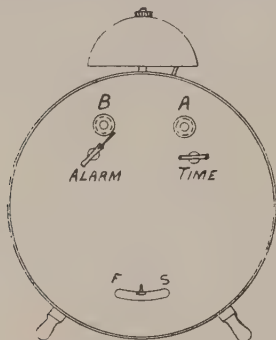
Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a non-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.]

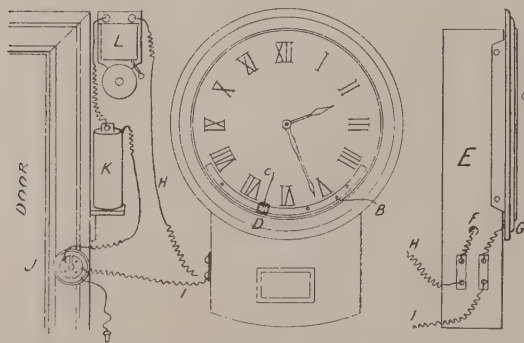
Electric Clock Alarms.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Having seen several methods of converting ordinary alarm clocks into electric alarms, I send a description of one I made and used myself, which is certainly reliable,



and cost only a few pence to fit, and is very simple. You procure two terminals, also a piece of copper wire and



two washers. First make two small holes in back of clock; insulate B terminal, but not A, and fix piece of wire to key of alarm; connect up in usual way. As soon as the alarm starts to ring, the copper wire turns and touches A, and makes a connection, and bell keeps ringing till switched off.—Yours truly,

London, S.E.

J. T. B.

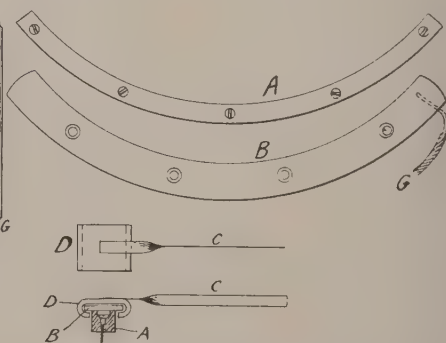
TO THE EDITOR OF *The Model Engineer*.

SIR,—After making various kinds of alarm bell attachments for clocks, I have just completed one which answers better and with less attention than any previous one. The clock is an eight-day office pattern. The only attention

required for the alarm is to move the switch "on" or "off," as desired, no nightly winding, as in the usual "alarm movements." I enclose sketch of clock, &c., as fixed, showing switch and cell fixed on moulding of door:—A is curved piece of ebonite or hardwood, 5-16ths in. square, reaching from IV. to VIII. on clock dial, outside the figures. This acts as insulator, and must be screwed on to dial. Let the screw-heads be sunk below the surface, so as to clear the conductor B, which should be cut $\frac{3}{8}$ in. wide, from sheet copper, and attached to insulator A with $\frac{1}{4}$ -in. screws, taking care that the screw points do not reach clock dial. The contact piece D slides on the conductor B, and has soldered to it a strip of hard springy brass (C), very thin, and $\frac{1}{8}$ in. wide; when fixed in position the point of this spring "trigger" should overlap the point of hour-hand about 1-16th in. E is side view of clock, showing direction of wires; F wire passes through the clock case and is soldered on to front plate of works; G is the other wire soldered on to conductor B, and passes through hole in dial to its terminal at side of clock case; H wire from clock works to bell L; I wire from conductor B to switch J; switch is made from a pennypiece cut in half and screwed on to a 3-in. gas-block, with a copper rivet for "peg." In sketch the trigger is set to go off at 6.30; by continuing the insulator A and the conductor B in complete circles round dial, the full twelve hours would be encompassed, but I find from 4 o'clock to 8 o'clock to be sufficient. Mine would ring for eight minutes if not switched off; this, of course, depending on the overlap of trigger C and hour-hand. I have found this far better than a continuous ringing bell, as children or others placing the switch "on" when not required, might, with continuous bell, run the battery down, or (as happened in my case) should alarm go off with house locked up, cause a burglar scare amongst the neighbours, and a forcible entrance by the police.—Yours truly,

Scarborough.

W. P.



TO THE EDITOR OF *The Model Engineer*.

SIR,—The idea mentioned in your January issue is an old one, and I would not recommend it to be adapted to clocks, as one of my friends had it working on this principle, and I followed this idea, but I soon found out that my clock was losing considerably, owing to the electric current running through the works causing magnetism, therefore binding the works together. This is why I thought to let your readers know of a simple appliance for an alarm clock, which appeared in your December issue, so as to avoid good and valuable clocks being spoiled.—Yours truly,

Brynmarw.

"EXAMINER."

TO THE EDITOR OF *The Model Engineer*.

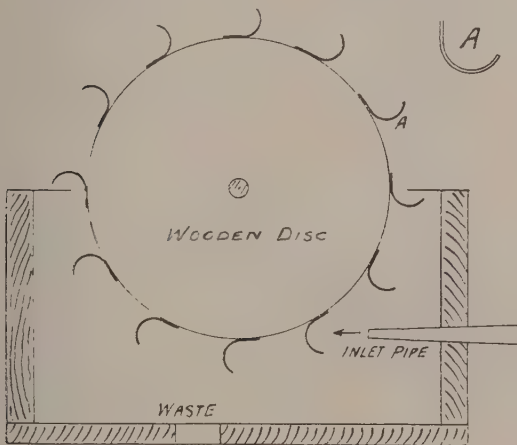
SIR,—With reference to "Amateur's" letter on the above subject, I think he has made a slight error in his connections, as most alarm clocks are made with the bell screwed to the metal casing, and this casing is in metallic connection with the works. I think if the connections are made as "Amateur" suggests, he will get a "short circuit" through the clock, and the bell will ring whether the hammer is touching the bell or not. This, of course, could be avoided by putting an insulating washer where the bell touches the metal support, thus avoiding any metallic connection between the bell and the hammer.—Yours truly,
W. J. A. L.
Newcastle-on-Tyne.

A Simple Water Motor.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Amateurs who have machines, wish to have some power for driving them. The water-motor here described can be driven from the kitchen tap, or from an elevated rain-tub, and is very simple in construction. The only tools that will be needed are a hammer, screw-driver, saw, and a few screws (different sizes) and nails.

Commence first with the wheel. Get from a sawmill a circular piece of wood, 2 ins. thick by 9 ins. diameter. Next go to a tin-smith's shop and get twelve pieces of tin, 2 ins. by $1\frac{1}{2}$ ins. Each piece must be bent breadthways as at A. Through the centre of the wheel bore a hole $\frac{1}{4}$ in. in diameter, and having divided the circumference



into twelve parts, screw each of the twelve pieces of tin on. Next make the axle out of a piece of $\frac{1}{4}$ in. gaspipe, 8 ins. long, and fasten the wheel on the axle. Get two pieces of wood 7 ins. by 12 ins. by $\frac{3}{4}$ in., and two pieces 7 ins. by 3 ins. by $\frac{3}{4}$ in., and one piece $13\frac{1}{2}$ ins. by $\frac{1}{2}$ in. by $\frac{3}{4}$ in. and nail them together in the form of a box. In one of the short sides cut a hole for inlet pipe, and in the bottom another larger hole for waste-pipe.

To make a pulley for the water-motor, melt some lead in a pan; make a mould of your pulley wheel, run lead in and let it cool. When cool, take it out and in the centre of it bore a hole $\frac{1}{2}$ in. in diameter, and having fitted it on to the axle, the motor is then ready.—Yours truly,
Leigh, Lancs. J. P. F.

Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.]

The following are selected from the queries which have been replied to recently:—

[406] **Electric Launch.** P. H. S. W. (London, W.) writes: Size of boat, 20 ft. long by 5 ft. beam; maximum draught, 1 ft. 6 in. Wanted to drive at maximum speed of 10 miles per hour. Please state type of motor, maximum b.h.p., revolutions per minute, and where it can be obtained; also full details of accumulators for above—viz., voltage, number of cells, number of plates + and - per cell, size of plates, approximate weight, etc.

To drive a launch 20 ft. long by 5 ft. beam at ten miles an hour, the motor should develop about 1 h.p. The best form of motor is an ironclad (somewhat similar to a Manchester or Lahmeyer), with drum armature 3 in. or 4 in. diameter, 5 in. or 6 in. long, series wound. The speed of the armature will be about 1,500 revolutions per minute. Of course, this must be geared down. Such a motor can be had from any good maker. About twenty-five accumulator cells, equal to 50 volts of 15 plate B type, such as are sent out by the Electric Power Storage Company will be needed. These cells cost about £22s. each, and weigh, when filled with acid, 57 lbs., and are capable of giving 20 amperes for six hours at a stretch. They are made specially to suit the sloping sides of launches, being 8 in. long, $13\frac{1}{2}$ in. high, only 8 in. wide at bottom, and $10\frac{1}{2}$ in. at top.

[416] **Are Electric Wires Dangerous?** H. K. (Upper Clapton), writes: (1) Will you tell me if there is any danger, during a thunderstorm, in having any electric wires over the head of my bed? They are used for telephone, light, and bell, the three being worked by an earth-current; the return is connected with the gas-pipe; two of the wires run through the house into the garden, to a shed. (2) Does it improve the "microphone pencil" by making it red-hot, and dipping it in mercury?

(1) There would be no appreciable increase in danger; on the contrary, the wires form so many paths of good conduction to earth. (2) Heating the microphone pencil and immersing it in mercury causes it to imbibe a certain quantity of mercury, and this increases its conductivity *pro tanto*; but it is very doubtful whether any real advantage in working is thereby gained—firstly, because the exact amount of conductivity of the carbon is not of great moment, so long as it varies with the varying undulations; and secondly, because the mercury soon oxidises and loses its conductivity.

[501] **Model Loco.** F. P. (Newcastle-on-Tyne) writes: I am thinking of building a model locomotive of about 1-in. scale. Could you tell me what gauge would be best, and what style of locomotive would be most suitable, and what diameter driving wheels? I should not want the loco so much for speed as for pulling heavy loads. The gradients would be steep and the curves sharp.

The standard gauge of 4 ft. $8\frac{1}{2}$ ins. for an inch-scale model locomotive would be best. A four coupled tank-engine, with a bogie of any modern type, would make a good model and do the work you require. The driving wheels would be $5\frac{1}{2}$ ins. diameter; boiler, $4\frac{1}{2}$ ins.

diameter, $10\frac{1}{2}$ ins. long, with ten $\frac{3}{8}$ -in. tubes; outside firebox $6\frac{1}{2}$ ins. long and $3\frac{3}{8}$ ins. wide; cylinders, $1\frac{1}{2}$ -in. bore and 2-ins. stroke; gauge of rails, $4\frac{3}{4}$ ins. nearly.

[502] **Boiler Queries.** E. W. (Burnley) writes: A vertical boiler in MODEL ENGINEER No. 5 reply to E. W. (Burnley). (1) Instead of using sheet iron for shell would a piece of iron or steel tube do as well? If so, where could same be obtained, and what would be probable cost of it? (2) Can crown plates be flanged by hand? If so, what would be the simplest tools to use? (3) How is flue fastened to crown plates instead of being riveted? (4) Would crown plates do in cast iron? If so, what would be thickness of same to be safe? (5) What would be the weight of sheet metal for above boiler?

(1) Steel or iron tube would do well, but it is doubtful if it can be obtained of the size required. You might write to some of the tube makers advertising in the engineering papers. (2) Yes, plates should be made red hot and the flange worked all round by hammering on a block of iron with rounded edge and curved to radius of the crown plate. (3) The flue may be a piece of $2\frac{1}{2}$ -in. or 3-in. steam pipe screwed at each end with a nut each side the crown plates, the joint being made steam tight with red lead. (4) Yes, about 5-16ths in. thick. (5) About 56 lb.

[519] **Model Torpedo Boat.** W. H. S. (Blackheath) writes: I am thinking of making a model torpedo boat or destroyer, 30 ins. long. I wish to drive it by steam at the greatest speed possible—in fact, speed is everything, and I don't mind if the boat is all boiler and engines so long as I get the speed out of her. (1) Would you kindly give me most suitable beam and depth of boat. (2) Dimensions and design of boiler. (3) And best fuel for same. (4) The most suitable engines. (5) Also the diameter of the twin screws. (6) Would it be better to drive the shafts by separate cylinders, and gear the one into the other, or not? I have a small clockwork boat, 18 ins. long, of cigar shape, and the screw is 3 ins. diameter. It is the fastest boat of its size I have seen; but, owing to its only having one screw, when in motion it has a large list in the opposite direction to that in which the screw is turning. (7) What would be the best number of blades on the screws?

Torpedo boats and destroyers are about 10 beams to the length; a model 30 ins. long will therefore be only 3 ins. wide and about 3 ins. deep. The boiler may be of the type shown in reply 407, and about 6 ins. long; single slide valve engine, $\frac{1}{2}$ in. by $\frac{1}{2}$ in.; screw 2 ins. diameter. This would be an extremely small boat to go by steam, and it would be doing well if it reached $\frac{1}{2}$ mile per hour. A boat twice the size might run at a speed of 3 or 4 miles per hour. One screw would be best for speed. The cause of clockwork model listing over is in the large size of screw compared to the length of boat. Screw may have two or three blades.

[529] **Launch Engine.** A. K. (Brixton) writes: I am making a double cylinder launch engine, 3 ins. diameter, $3\frac{1}{2}$ ins. stroke, steam pressure 150 lbs., to be put in a 20 ft. to 25 ft. boat. What size propeller and pitch should I require? Number of revolutions? Speed being first consideration, also what size boiler, loco type preferred?

Propeller, 1 ft. 9 ins. diameter and 2 ft. 6 ins. pitch. From 300 to 400 revolutions per minute. Boiler, 1 ft. 9 ins. diameter, 3 ft. 6 ins. long, including firebox, which may be 1 ft. 10 ins. square at bottom and 1 ft. 6 ins. deep, water space 2 ins. all round, grate about 1 ft. 5 ins. square. Put 30 tubes in boiler $1\frac{1}{2}$ ins. diameter and 2 ft. long. Boiler plates $\frac{1}{8}$ in. thick.

[535] **Model Loco Boiler.** H. J. H. (Manchester) writes: I am making a model locomotive with two simple cylinders, $1\frac{1}{2}$ ins. by $2\frac{1}{4}$ ins. stroke. Will the

following dimensions for boiler suffice to stand 60 lb.? What number and diameter of tubes shall I put in, also what thickness of shell and firebox in copper boiler? Barrel $4\frac{1}{2}$ ins. diameter and 12 ins. long, firebox $5\frac{1}{2}$ ins. deep by 5 ins. long by 3 ins. wide, with water space all round.

The cylinders are too large for the boiler; they should not exceed $1\frac{1}{2}$ ins. diameter and 2 ins. stroke. Put ten tubes in boiler, $\frac{3}{8}$ in. diameter shell, and firebox 1-16th in. thick. A boiler for the $1\frac{1}{2}$ -in. cylinders should be 6 ins. diameter, about 16 ins. long, firebox 8 ins. long, $4\frac{1}{2}$ ins. wide, 8 ins. deep, metal 3-32nds in. thick, ten tubes $\frac{3}{8}$ in. diameter.

[537] **Force Pump.** J. C. C. (Walthamstow) writes: Would you kindly let me know in the November number of THE MODEL ENGINEER if it is advisable to fit a force pump (feed pumps) to a copper marine engine 7 ins. long, $4\frac{1}{2}$ ins. deep, and $3\frac{1}{2}$ ins. wide; engine $\frac{3}{8}$ -in. bore, 1 in. stroke; and if not too much trouble, the best method of doing it?

A force pump worked direct from the engine would absorb nearly all its power; very small pumps do not work well at high speeds. It would be better to put in a hand-force pump similar to that described in the March number. A piece of rubber tube could be connected to suction, and the delivery pipe connected to boiler as low down as possible, a small tap being fixed next to the boiler, which can be turned off when the pump is not in use.

[544] **Horizontal Boiler.** T. M. writes: Will you give drawings for a suitable horizontal boiler, to use charcoal for an engine 1 in. bore and 2-in. stroke? Would this engine drive a 50-watt dynamo?

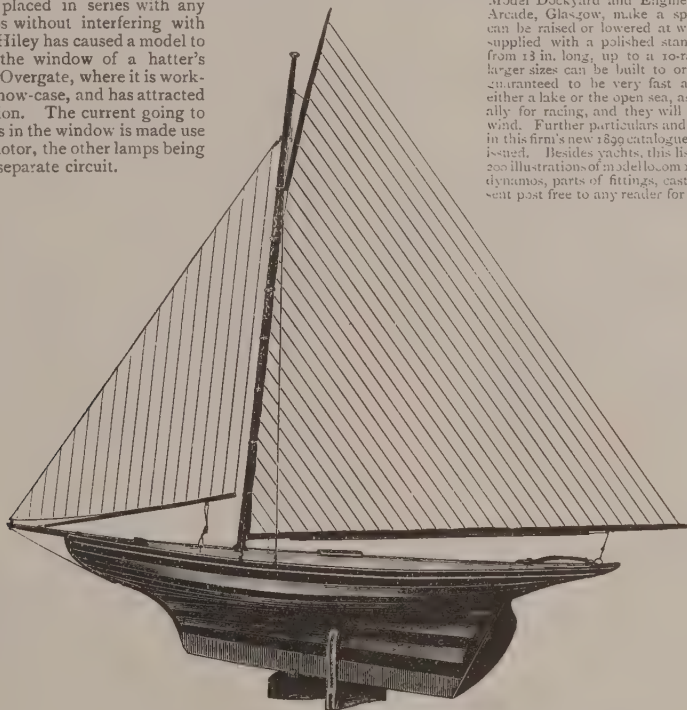
Boiler 6 ins. diameter and 12 ins. long with a fire-tube of oval section, $4\frac{1}{2}$ ins. wide, and 6 ins. long. Brass wire stays 3-16ths in. diameter should be put in to give extra strength. For a pressure of 30 lbs. use copper 1-16th-in. thick. The engine would drive a 10 to 15 watt dynamo.

Jottings.

ARRANGEMENTS are being made at the South Foreland Lighthouse and on board the South Goodwin Lightship for a series of experiments in wireless telegraphy. The experiments will be under the personal direction of M. Marconi, who is accompanied by other experts. If the experiments are considered satisfactory, as there is reason to believe they will, it is stated that the wireless system will be adopted forthwith as a means of communication between the South Foreland Lighthouse and the South Sands Head Lightship. The position of the Goodwins is a very important one in regard to shipping disasters. The points of communication are only about three miles apart. It is stated that experiments between England and France are also proposed.

Mr. J. M. Hiley, foreman electrician with Messrs. James Maxwell and Son, Dundee, has invented and patented a new electric motor. The machine, says the *Dundee Courier*, is designed to utilise the current employed for lighting purposes on its passage to the lamps without diminishing the power thereof. At present the electric energy loses a proportion of its power on its way along the wires, but Mr. Hiley's motor will prevent this loss, and intercept for its own propulsion the energy which would otherwise be wasted. He has departed from the usual way of constructing motors, in so far that his machine is an arrangement of horseshoe electric magnets. The rotary part is composed of four of these magnets

mounted on a spindle, and wound in such a manner that the current is commutated to change the polarity of any one of the magnets at a suitable moment. The poles being mounted on a metal disc, the current is free to pass from any one pole to any other. Therefore, any two adjacent poles may form a complete horseshoe magnet. By partially rotating the brushes round the commutator, the speed of the machine may be governed. The field magnet terminates in a T piece—that is to say, each pole is extended on each side of its axis so as to be opposite two or more poles of the armature or rotating part. They are so fixed to cut out the torque at the moment there is a change of polarity in one of the rotating magnets. By this construction, sufficient copper can be used in the winding to carry any desired amount of current. The machine can be placed in series with any number of lamps without interfering with the power. Mr. Hiley has caused a model to be fitted up in the window of a hatter's establishment in Overgate, where it is working a revolving show-case, and has attracted a deal of attention. The current going to three of the lamps in the window is made use of to drive the motor, the other lamps being supplied from a separate circuit.



CLYDE-BUILT MODEL RACING YACHT.

Amateurs' Supplies.

[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.]

Small Gas Engine Castings.

We are asked by Mr. M. Kompler, of 7, New Basinghall Street, London, E.C., to state that as the sale of the castings he is advertising has already been amply sufficient to recoup him for the expense involved in getting out the patterns, &c., he is now enabled to reduce the prices considerably. For the complete set of castings and all parts the revised price is 50s, while for the castings alone the price is 35s. Customers can have the fly-wheel either finished or in the rough. If the latter, a further reduction in price is made. Amateurs wishing to make their engines who have not got the working drawings presented with our November issue, can obtain copies from Mr. Kompler, post free, for 1s. A descriptive circular of the gas engines can be had for one stamp.

Small Pressure Gauges.

From Messrs. W. J. Russell-Lawke & Co., 18 and 20, Kingswell Street, Northampton, we have received a neatly-made sample of small pressure gauges which this firm supply. The gauge is $1\frac{1}{2}$ in. diameter, registers up to 45 lb. per square inch, and is fitted with nut and tail-pipe for connecting. Other sizes are made, ranging from $\frac{1}{4}$ in. diameter up to 3 in. diameter, the prices ranging from 4s. 6d. to 5s. 6d. each. Dummy pressure gauges, suitable for watch chain ornaments, are supplied at 6s. 6d. each. Complete lists of the model fittings which this firm supply can be had on application.

Model Racing Yachts.

The accompanying illustration shows a new design of a Clyde-built model racing yacht, which appears to possess many features of interest. The hulls of these boats are built of teak and yellow-pine planked alternately, the planks being rivetted on ash ribs and every seam caulked. The body is beautifully varnished and finished. The lines of these boats are taken from noted winners among larger craft. Patent quadrant steering gear is fitted, and the sails are cut from a pretty blue-striped model sail cloth, of which the builders—the Clyde

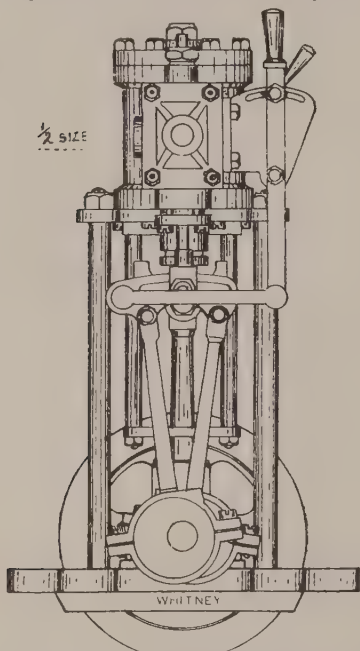
Model Dockyard and Engine Depot, 24, Argyle Arcade, Glasgow, make a speciality. The sails can be raised or lowered at will, and each boat is supplied with a polished stand. The sizes range from 13 in. long, up to a 10-footer (5 ft. long), but larger sizes can be built to order. The boats are guaranteed to be very fast and steady sailers on either a lake or the open sea, as they are built specially for racing, and they will run very close to the wind. Further particulars and prices will be found in this firm's new 1899 catalogue, which has just been issued. Besides yachts, this list contains nearly 200 illustrations of model looms, lathes, launch engines, dynamos, parts of fittings, castings, &c. It will be sent post free to any reader for 4d.

W. A. C. Smith, 51 and 53, Dury's Street, Glasgow.—A new catalogue for 1899 has just reached us from Messrs. W. A. C. Smith and is full of interest to electrical amateurs. Parts for bells, batteries, and dynamos in great variety are supplied by this firm, and are illustrated in this list. Accumulators of various types, clock alarms, induction coils, Wimshurst machines, and sundry other electrical apparatus are to be found; and a table of copper and platinum wire giving sizes and price is a most useful item. The catalogue will be sent to any reader of this paper on sending a penny stamp for postage.

Reynolds Bros., 38, Pitt Street, Barnsley, Yorks.—This 1899 catalogue sent us by Messrs. Reynolds Bros. contains a number of interesting new features. Amongst these are some horizontal steam engine castings and other parts for engines from $\frac{1}{4}$ up to 2 h.p. Photographs are given of two of the finished engines, which show them to be of good substantial design. Messrs. Reynolds also call attention to their small-power gas engines, and amongst other items we note they supply lathe castings, parts for dynamos, and boilers. The list will be sent to readers of THE MODEL ENGINEER on receipt of three penny stamps.

Model Engine Castings.

A short time ago we made mention of some good sets of model loco castings made by Mr. Pearson, of Howarth's Inventors' Bazaar. Since that notice appeared, the patterns for these and for some neat launch engine sets have been taken over by Messrs. Whitney, of 117, City Road, London, E.C., who are prepared to execute all orders for same. In the drawing we give herewith we show to a scale of half-size one of the single launch engines, which are made in three sizes, with cylinders of 5-8ths and 7-8ths in. and 1½ in. bore respectively. There are also two sizes of double cylinder launch



engines made, the two cylinders being cast in one. All these launch engines are fitted with link motion reversing gear. The model locomotive which has cylinders of ¾ in. bore by 1½ in. stroke, we have previously referred to. We have inspected sample sets of castings, which are in best gunmetal and brass, and have found them to be very clean and sound. Complete working drawings of any of these engines can be had for six stamps, which are allowed if an order is given; or for one stamp a complete illustrated sheet giving all particulars and prices will be sent. We can recommend these castings as well worth the attention of our readers.

Catalogues Received.

Butler Bros., Upper Dale Road Works, Derby.—We have received a new and enlarged catalogue of electrical and other specialties made by Messrs. Butler Bros. All the dynamos turned out by this firm are made with laminated armatures and reliable lubricators. Advantages are also claimed for the brushes and commutators, the latter being made of a special alloy which reduces sparking to a minimum. The bearings in all cases are of hard gunmetal, calculated to stand wear. A very complete list of armature laminations, ranging from 1 in. diameter up to 12½ in. diameter, with prices attached, forms a feature of considerable use to the dynamo builder. Other pages give illustrations and prices of complete oil, gas, and steam engines, and small boilers, as well as particulars of sets of castings for many of above.

F. & H. Shaw, Limited, Helden Bridge.—A few of the special tools and machine details manufactured by this firm are described and illustrated in a supplementary list sent to us recently. We note some good lines in bearings and shafting of small dimensions, and some novel clamps and packings. Messrs. F. & H. Shaw claim to make tools in every variety, and a perusal of their list will convince anyone that their specialties and devices are thoroughly up-to-date.

Olney & Warren, 36, Day Street, New York.—This firm send us a very attractive descriptive catalogue of their model locomotives. They are making all details for a model of one of the finest American locomotives in three sizes, keeping strictly to correct proportions, and they state that the finished engines will be exact working models of the famous "370" class on the N. Y. C. & H. R. R. R. A complete catalogue of model stationary and yacht engines and boilers will be sent to any reader upon application.

The Model Supply Co., Balfour Street, Bradford.—An interesting little catalogue is sent us by this firm, who make it their business to supply castings and other details of models described in the pages of THE MODEL ENGINEER. Thus, they supply sets of castings in brass and aluminium of Mr. Spicer's prize engine, Mr. Skinner's engine, "A.W.M." dynamos, model goods wagon, and so on. There are also numerous dynamos, steam and gas engines, supplied in parts as well as finished complete. This handy list, which is an improvement on the last issued, will be sent post free on receipt of three penny stamps, which sum is allowed out of first order for 2s. 6d. and above. This firm also supply cheap sets of appliances for electro-typing and electro-plating for amateurs.

The Kennington Manufacturing Co., 192, Kennington Park Road, S.E.—From this firm we have received an illustrated leaflet describing a new domestic telephone of particularly neat and simple construction. The receiver, transmitter, and call-push, form practically one cylindrical body, the receiver with the push being movable, and the act of removal or replacement effects the necessary alterations in the connections. Those of our readers interested in telephones will find it worth while to send for this list, which may be had post free by anyone mentioning THE MODEL ENGINEER.

Theo. Tomlin, Breeze Hill Terrace, Oldham.—A concise little list of horizontal and vertical steam engine castings and other details is to hand from this well-established firm. The prices are quite within reason, and those about to construct models of the types mentioned should send for this catalogue.

W. J. Wells, Smallfields, Horley, Surrey, sends us a catalogue of complete steam and gas engines, dynamos, motors, and boilers.

A. G. Thornton, 68, St. Mary's Street, Manchester.—A useful list of second-hand and shop-soiled drawing and surveying instruments has just reached us from Mr. Thornton, which readers in search of bargains would do well to obtain. There are nearly 300 items for disposal, ranging from single instruments to complete sets in cases, and including a variety of really cheap lots in scales, drawing boards, papers, and drawing-office sundries. The list will be sent post free on application.

The Portable Furnace and Patents Co., Ltd., Carrington, Nottingham.—This company have sent us an illustrated sheet descriptive of the small portable furnaces which they manufacture. The heat is obtained from an oil blast, and the furnaces are useful for a variety of work, such as bending pipes, melting metals in small quantities, heating copper bits, generating steam, &c. The price list may be had by any reader free on application.

Correction.—In the advertisement of Mr. G. Bowron, last month, the address was given as 37 instead of 57, Edgware Road, London, W. Will readers who are writing for his list of electrical bargains kindly note?

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 3s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All correspondence relating to advertisements to be addressed to the ADVERTISEMENT MANAGER, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All subscriptions and correspondence relating to sales of the paper to be addressed to the publishers, Dawbarn & Ward, Limited, 6, Farringdon Avenue, London, E.C.

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THE Model Engineer

AND Amateur Electrician.

A JOURNAL OF MECHANICS AND ELECTRICITY FOR AMATEURS AND STUDENTS.

EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

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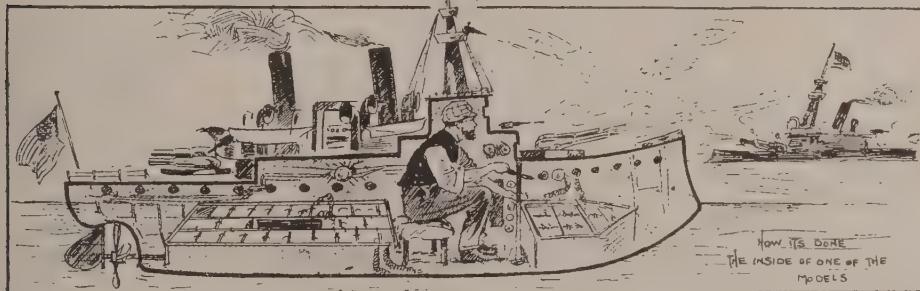
PUBLISHED
MONTHLY.

Model Battleships at Olympia.

How They are Worked.

THE large section of our readers who are interested in model boat building will probably be glad to have a few particulars regarding the construction and working of the miniature battleships, cruisers, and torpedo-boats with which such a realistic display of naval warfare is being given as one of the many attractive items in Messrs. Barnum & Bailey's immense entertainment at Olympia. To Londoners no introduction of these model

battleship "Oregon" we gleaned some instructive details regarding this imposing fleet. The boats are propelled electrically, the current being taken from a battery of thirty-six accumulators carried amidships in the hull of the vessel. The motor, which is about $1\frac{1}{2}$ h.p., is connected through gearing to a propeller shaft carrying a two-bladed propeller, about 12 ins. diameter. The speed of the motor is geared down about 3 to 1. The "Oregon" model, which is one of the leading vessels of the U.S. fleet, is about 15 ft. long, by about 2 ft. 6 ins. beam amidships. The torpedo boats average about 11 ft. long, and about 18 ins. beam. Each vessel carries a crew of



SECTION THROUGH ONE OF THE MODEL SHIPS.

(Reproduced by special permission from the *Penny Illustrated Paper*.)

vessels is necessary, for there is at present hardly a thoroughfare of any importance but contains one or more huge posters giving a vivid representation of the naval manoeuvres to which we are referring. For readers in more or less distant spots we may premise that the entertainment reproduces, as faithfully as the art of the model maker permits, the celebrated victory of the American fleet over the Spanish vessels at the mouth of Santiago Harbour.

Thanks to the courtesy of the management, we were recently enabled to take a peep behind the scenes to see the vessels at anchor just before starting on the eventful cruise of the evening. We found some ten men-of-war ready for the fray, and from the skipper of the U.S.

one, who combines the duties of captain, chief engineer, gunner, helmsman, and signalman. He is seated in the forward portion of the ship, and places his head in the conning tower, where perforated plates enable him to study the miniature ocean and the movements of the enemy in comparative comfort and safety. The general arrangement of one of the larger vessels will be clearly seen from the accompanying illustration, which we are able to present to our readers by the kindly-accorded special permission of the Editor of the *Penny Illustrated Paper*. The guns, of which the "Oregon" carries four, are charged with ordinary blank cartridges, and are fired by pulling a lanyard from within the hull. Each vessel is fully equipped

with electric light, including a powerful search-light, side and masthead lights, and special coloured lights on the mast for signalling at night.

The battle takes place, of course, on real water, the scenery in the background representing the approaches to the narrow channel leading to the harbour of Santiago, with the famous Morro Castle near the summit of the mountain. The lighthouse, forts, &c., are all in evidence as also is the beach where the ill-fated Spanish ships were run ashore. Briefly the manoeuvres and fighting may be detailed as follows: Night-time—American fleet appears and manoeuvres about in accordance with electrically flashed signals; the forts ashore open fire on the vessels; submarine mine explodes; cruiser chases torpedo boat and subjects her to hot fire; next a sailing vessel appears upon the scene; day breaks; cruiser bears down on a ship and fires; the sailing ship catches fire and becomes a wreck, the falling spars and masts making a very realistic effect; then an exciting arrival—the “Merrimac,” which steadily steams into the centre of the harbour channel under a very heavy fire from the forts; she blows up and settles down exactly as in the original dramatic episode. At this moment the Spanish fleet comes out of the harbour; the American guns blaze and bang away merrily; the Spaniards respond; then one of the forts ashore blows up; and finally the Spanish ships are driven ashore under a withering fire, hopeless and helpless wrecks. Then to the tune of the “Star-Spangled Banner” the curtain falls. Altogether, we found it a model display in more senses than one, which we can heartily recommend our readers to inspect.

A Model Electric Tramcar Motor.

By A. H. AVERY, A.INST.E.E.

THE little motor here described was specially designed for the purpose of driving model electric tramcars, the object being to economise weight and space as much as possible.

There are several novel points in its construction; for instance, the position of the armature with regard to the fields, the brush gear and commutator design, &c.; all of which combine to make it a very compact and powerful little motor for the weight.

And its sphere of usefulness is by no means confined to tramcar work; it is equally well adapted for any purpose where a light motive power is required.

Small motors are often regarded with disfavour by amateurs, who may, perhaps, find their appliances or their skill sorely taxed in fitting together some small machines of very unmechanical design. There is, indeed, in the majority of cases more work and more care required in fitting a small machine than a large one. In this instance, however, the work is not of so delicate a nature, the mechanical details having been so far simplified that the amateur will find no particular skill necessary; nor is there any risk of breakages through extreme delicacy of the parts.

With the aid of the following instructions, a really serviceable motor can be built—one that is perfectly self starting; will neither heat injuriously nor spark, with a fixed position of the brushes; has due provision for adjustment, and the taking up of any wear, will not tear itself to pieces; and has a fairly high efficiency. Wound in series, it takes 6 volts $2\frac{1}{2}$ amperes at full load, runs at about 2,500 revolutions per minute, and develops quite sufficient power to propel a model tramcar or motor car containing itself and battery—a dead weight of some 15 lb., perhaps—at a high rate of speed on the level.

Most amateurs will doubtless prefer to purchase the

castings, unless they have had some little experience in the art of pattern making; in which case an exact model of the carcase (Fig. 1) shown in plan (A), end (B), and side (C) elevations, should be constructed of hard wood. The patterns should be coated with shellac varnish, or painted, and afterwards rubbed down smooth. A “core-print” $1\frac{1}{8}$ ins. diameter must be provided for taking out the space between the pole-pieces, beyond which it is allowed to project about 3 ins. on the outside, but flush inside. The carcase is then divided into halves lengthwise, as indicated by the dotted line B, for convenience in moulding. The pattern for the gunmetal bearing (D and E, Fig. 1) may be left quite solid. The drawings are shown exactly one-half of full size.

In commencing to fit the castings, the first operation will be to machine out the armature bore and centre for the pointed setscrew, forming a bearing for one end of the armature shaft. Mount the carcase on a face-plate, holding down by iron straps passed over the winding

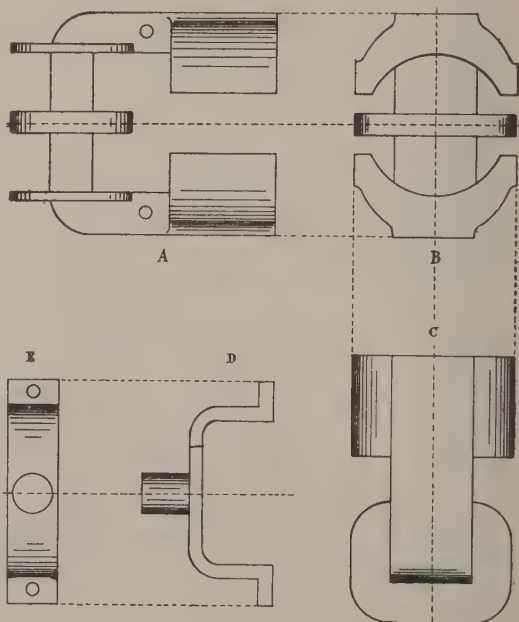


FIG. 1.—CARCASE AND BEARING.

spaces of the yoke, leaving the centre flange exposed; care must be taken that the latter is well centred side ways. The pole pieces are then bored out with an ordinary lathe boring tool to a diameter of 1.2532nd ins. Before disturbing the carcase, form a centre with a V tool in the middle flange of the yoke concentric with the armature bore, and drill a hole right through with a 5/32nds in. twist drill, this hole will afterwards be tapped out to 3/16ths in. to take a long, well-fitting, and finely-pointed set screw. A small locknut should be provided at the pointed end. But previous to removing the carcase from the face-plate, face off the ends of the pole-pieces to ensure a good seating for the bearing feet.

The armature core is built up of soft iron laminations

1-32nd in. thick, about thirty-two in number, each with six teeth 7-16ths in. wide by $\frac{1}{4}$ in. deep, with a centre hole $\frac{3}{8}$ in. diameter. The dimensions of the shaft are given in *a* (Fig. 2), which also shows the core-plate fixed in position by means of an ordinary $\frac{1}{4}$ in. hexagon nut turned out and tapped with a $\frac{3}{8}$ in. brass thread. The thread on the shaft is continued for some distance beyond the end of the nut, for on this the commutator will presently be screwed.

The coned portion, which forms the front bearing for the shaft, tapers down from 5-16ths in. to 7-32nds in., at an angle of about 30 degs. A fine centre should be left in the other end of the shaft, and this deepened with a very small drill to serve as an oil reservoir.

is now ready to fit to the carcase. Having inserted the pointed screw through the yoke to serve as a back centre, wrap a piece of thick brown paper round the armature core so that it will just push lightly in the bore of the pole-pieces, with the end of the shaft against the back bearing. This will keep the armature exactly in the middle of the bore, whilst the front bearing is fitted on. Having previously chalked the end faces of the pole-pieces, to show the marks better, slide the front bearing down the shaft, and, holding it squarely and firmly on the carcase, scribe round inside the screwholes in the feet; or, better still, mark their position by means of a centre punch which exactly fits the holes. Drill to about $\frac{3}{4}$ in. depth with a $\frac{1}{8}$ in. tapping drill.

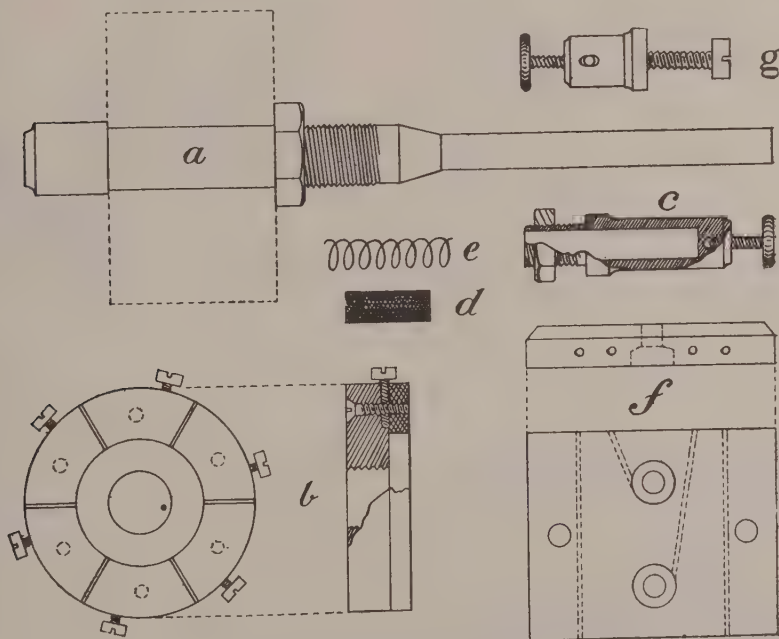


FIG. 2.—DETAILS OF COMMUTATOR, SHAFT, &c.

In fitting the gunmetal bearing, it may be gripped in a chuck, feet outwards, and the boss carefully drilled with a 7-32nds in. twist drill. The inside face of the bearing, and also the feet, are turned up before removing from the chuck, so as to ensure being square with the bore; and finally the inside end of the hole is opened out to the same taper as the cone on the armature shaft. The latter will now serve as a mandrel on which the bearing can be mounted, while the boss is turned down outside and polished. After this has been accomplished the shaft itself is reduced with a fine file, and polished with emery cloth until the bearing runs in position quite freely and with just perceptible shake. The web portion of the bearing is either filed up bright and lacquered, or left rough and afterwards enamelled. Two 1-8th in. holes are next bored in the feet, as shown in *E*, Fig. 1, and it

Remove the armature, and, after tapping these holes, replace it, this time without the paper. On screwing the bearing down now, it should show not the slightest tendency to "bind" the armature shaft. If it does, the bearing is not squarely set, and the feet must be adjusted by careful filing until the armature spins quite freely without any play in the bearing.

Passing to the commutator, which is generally viewed with apprehension by most amateur fitters, it will be seen on reference to *b* (Fig. 2), that the form devised by the author for small work in general possesses many advantages over the usual tubular form, since there is a much greater margin of mechanical strength; it also takes up so much less end-room, making the whole machine lighter and more compact.

(To be continued.)

A FAST MODEL TORPEDO BOAT DESTROYER

AND HOW TO BUILD IT...



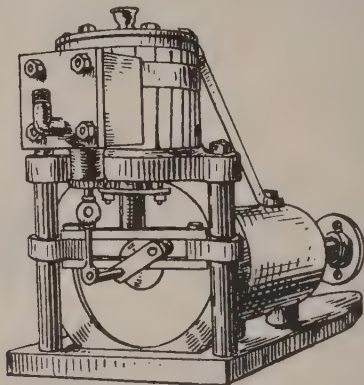
By H. E. MORRISS.

I PROPOSE, for the convenience of my readers, to give, in the course of this article, the chief dimensions of a fast model torpedo boat destroyer, which I have made, and have now had running for some time in the sea, and also in various ponds, with much success.

Of course, it could be made in a larger size, or even smaller, but I do not recommend anything less than 3 ft. 6 ins. in length, 5 ins. deep, and $4\frac{3}{8}$ ins. beam, which are the dimensions of the one I have made. The first thing is to get a nice piece of wood, or two pieces glued together will do, the dimensions of which will be a little more than those of the boat as given above, to allow for planing up. Of course, the wood should be as free from knots as possible, and of a kind that will be easy to work. Plane the block up true, and then draw a line round it lengthwise, dividing it into two equal parts. Rough it down with a saw, as shown by dotted lines in Fig. 1. Having done this, you will shape it up in the usual way with chisel, rasp, &c., finishing it off with a scraper (a piece of glass makes a very good scraper), and finally with glass paper. Take care to get both sides alike, as this is important.

Get a sheet or two of X charcoal plate, and cut it up into pieces 5 ins. by $1\frac{1}{8}$ in.; punch a small hole in the

can be drawn out, and this piece laid aside. Proceed in the same manner to make the other half. Having now



ENGINE FOR MODEL TORPEDO BOAT DESTROYER.

got the two halves complete, you will solder up on the inside the holes made for the tacks that fastened the plates to the wood block while you soldered them.

Make a piece of brass about 3-16ths in. thick and $\frac{1}{4}$ in. wide; shape as shown in Fig. 3; this is for the front of the boat, and forms the ram. Also shape up a tin keel, as shown in section at Fig. 4; this extends from the end C (Fig. 3) to the stern of the boat. Having got these parts made, you will proceed to securely solder the front part of the two halves to the piece of brass (Fig. 3), and the other part to the hollow keel, letting the plates overlap the flanges A B (Fig. 4). The stern plates will be soldered to a piece of tin, bent as shown in section at Fig. 5, in which a hole will be provided for the tube containing the propeller shaft to pass through. When this is all soldered up water-tight, the hull will be, for the present, finished. The boiler next claims our attention. Get, or cut out, two pieces of brass, bare 4 ins. in diameter, and about $\frac{1}{2}$ in. thick; lay the two face to face, and solder in one or two places on the edge, just sufficient to hold them together. Then mark out one face, as shown in Fig. 6, and drill a large hole at D, and small ones where it is marked E, the two pieces being done at one operation.

You will now require twelve pieces of $\frac{3}{8}$ -in. brass tube, and one piece $1\frac{1}{4}$ in. outside diameter, each of which will be 10 ins. long. These must be driven tight into the holes D and E (Fig. 6) and then *hard* soldered. The other materials necessary for the boiler are two pieces of brass tube $3\frac{1}{2}$ ins. diameter, about 1-16th in. thick, and $1\frac{1}{2}$ in. long; two discs of brass to fit inside tube; and two collars of brass to fit over outside of tube.



PHOTOGRAPH OF THE FINISHED MODEL.

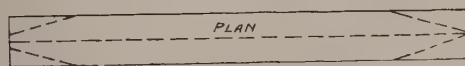
centre of each plate just sufficient to pass a gimpe tack through. Take one plate, and fix it to the wood block with a gimpe tack; then another, letting it overlap about 1-16th in.; solder the two overlapping edges together, and follow on with other plates in the same way, shaping them up as you go by hammering them on a piece of lead with a small ball-faced hammer. (See Fig. 2.) Having completely covered one-half of the wood block, the pins

Hard-solder collar F (Fig. 7) on to one edge of tube G (Fig. 7), and a disc into other end of tube; this will form the caps or boiler ends, as shown complete in Fig. 8. Mark out the collars for holes at suitable intervals, and centre same. Tack together with solder the collar marked F on Fig. 8, and the brass disc to which the tubes are attached, marked H on Fig. 8, and drill holes where you have already centered to take $\frac{1}{8}$ -in. bolts.

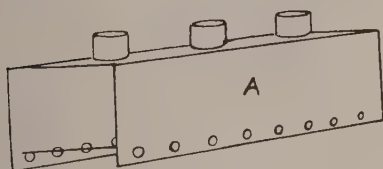
Now unsolder the collar from the other part and tap the holes in H (Fig. 8). The water-gauge can now be made and fitted to one end of the boiler as shown in



Fig. 1.

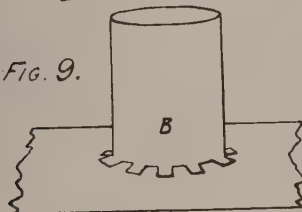


PLAN



A

Fig. 9.



B

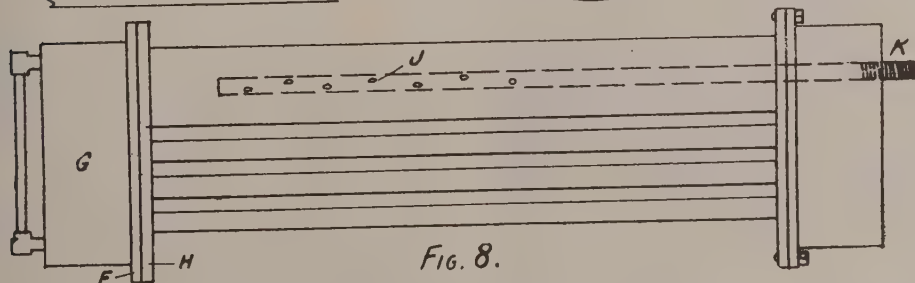


Fig. 8.

Fig. 8. Get a piece of tube about $\frac{1}{4}$ in. outside diameter, stop up one end, and cut a thread on the other, also drill some small holes in it, as shown at J in Fig. 8; fix it into boiler end, as shown at K in Fig. 8. This forms the pipe to supply steam to the engines, and will prevent the boiler from priming. The caps can now be bolted on with asbestos packing between the flanges. The boiler case is made by bending a piece of tin as shown in Fig. 9 (A). You will punch some holes along the bottom edges and three large ones at the top which communicate with the funnels. This case is attached to

boiler by means of tie bars passing under the last row of tubes. The tubes over which the funnels fix are fastened to the case by dovetailing the tin, as shown in Fig. 9 (B).

I will now proceed to describe the engines, and will presume that anyone who essays to make a model steam-boat, has already acquired a general knowledge of a slide valve engine, so shall confine my detail remarks to a description of the crosshead, the little crank which takes the place of the usual eccentric and sheave, and the ball-bearing, leaving the illustration to speak for itself as to the general build of the engine. First, as regards the

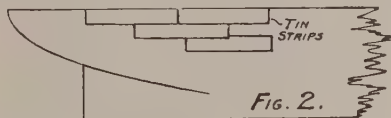


Fig. 2.

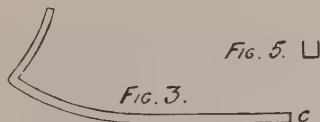


Fig. 3.

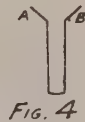


Fig. 4.

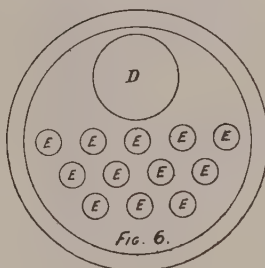


Fig. 6.

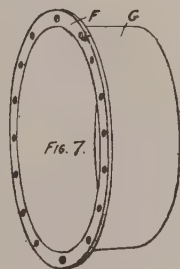


Fig. 7.

crosshead. Make two lugs, shape as shown in Fig. 10 (LL); Drill holes to take the rod which forms the guides, and also supports the cylinder. Then get two pieces of flat steel $\frac{3}{16}$ ths in. wide by $\frac{3}{32}$ nds in. thick, drill a hole in centre of one and tap end of piston rod into same.

Holes must now be drilled in each end of both the flat pieces of steel and also in the ends of the lugs. The holes in the bottom piece, shown as M in Fig. 10, must be tapped to take a bolt which will be passed through the other piece and also the lugs, and so join them together (see Fig. 10.) The slide valve is worked by a

little adjustable crank which is attached to the crank-pin which runs between the bars of the crosshead.

The line SS on Fig. 11 represents the centre of main shaft. The centre of pin N should be in a line with centre of main shaft as shown by line SS. The crank O is kept at the desired position by backnut P being screwed up against it on the crank-pin R. The pin N is also kept rigid by a backnut. This crank works the slide valve by it being put out of centre, the amount of which is regulated by the travel required by the slide valve.

The ball-bearing must now receive attention. The

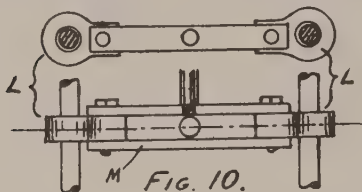


FIG. 10.

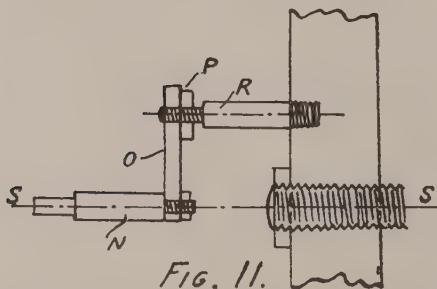


FIG. 11.

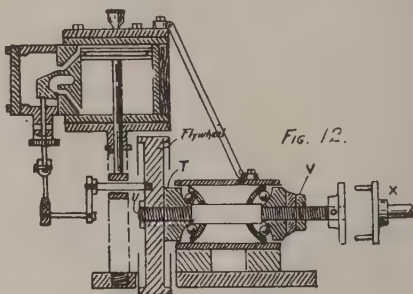


FIG. 12.

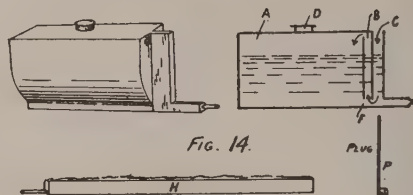


FIG. 14.

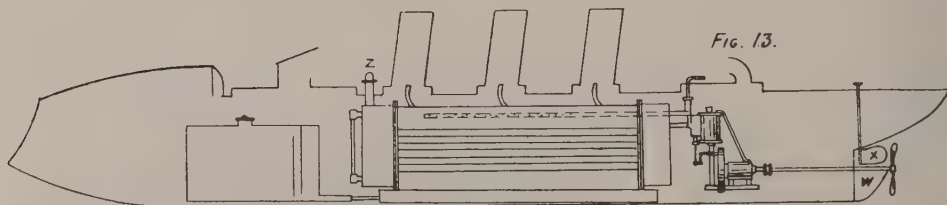


FIG. 13.

case is made out of a piece of brass tube, into which the two steel cups are driven; two pieces of brass are soldered on to the tube to form supports, and these are bolted to the bedplate. The main shaft of engine is turned down at both ends, which forms two shoulders; a thread is cut on each end. The two cones are tapped to screw on against one shoulder, and then the flywheel is screwed up against that, and finally the back nut U (Fig. 12) fixes them both. The cone on the other end is screwed on in the same way, and fixed by the back nut V (Fig. 12). One half of the coupling piece is screwed on at the extreme end, and fixed by a setscrew drilled through the shaft; the other half is shown at X (Fig. 12). The propeller shaft runs in a tube, which is bushed at one end to

form a bearing, and at the other end the stuffing-box is fixed.

It will be noticed in Fig. 13 that the tube which contains the propeller shaft extends beyond the actual stern of the boat, and that the tube with the stuffing-box is fixed to the piece marked W on Fig. 13. This allows for the rudder (X, Fig. 13) to be fixed as shown in front of the propeller.

The propeller, which has two blades, is fixed to the shaft by drilling a hole through the boss of the propeller and the shaft at one operation, and then driving a pin through same.

The bedplate of engine is screwed down to two pieces of flat brass, which are made fast to the sides of the hull of the boat. The safety valve (Z, Fig. 13) is made to screw out, so that it answers as a boiler filler as well.

The exhaust steam is taken up the funnels. A piece of $\frac{1}{4}$ -in. brass tube is taken along between the boiler case and side of the boat, and branched up each funnel.

The handle on the steamcock on supply pipe to engine is taken above deck, so that it can be turned on or off without removing any of the covers.

We will now deal with the spirit tank and burner (Fig. 14.) This tank is made of tin, and shaped to fit into the bow of the boat. The burner is also made of tin, and fits into the groove formed by the hollow keel at the bottom of the boat. A flat wick is laid into it and

saturated with spirit; it is then placed in the boat under the boiler. To fill the tank, remove cap D at top, and place plug P (Fig. 14) in the hole marked E. When you have poured the spirit into the tank it will be as shown, in section of tank (Fig. 14), by the dotted lines. The tank will now be placed in the boat, G and H connected, and the plug P withdrawn. The wick now being lighted, will consume the spirit in the compartment C (Fig. 14); this will allow the air to pass down C, up B, and into A, as shown, and allow the spirit to run out at F, which will,



in its turn, be consumed, and again allow free passage for the air into the tank. So the operation is repeated until all the spirit is burnt up.

The deck, as a whole, is soldered flush with the sides of the hull; the front part is arched as shown in Fig. 13.

The front trap is made sufficiently large to allow spirit tank to go down it. The ventilator on this trap is made to represent a conning tower (Fig. 15); the windows are cut out and backed with mica. The bases of the funnels are perforated with some small holes, to allow of the cool air passing between the sides of the boat and the boiler case. There are two ventilators on the aft trap, and these are turned with their mouths toward the bow of the boat, but the forward one, as will be seen in Fig. 13, is turned the other way. This boat is quite seaworthy. If the traps are nicely fitted it will not take any water to hurt, unless submerged below the ventilation holes. I have had it steaming at the rate of $3\frac{1}{2}$ miles per hour.

[If any readers have difficulty in getting the parts or materials for making this model, or require further advice, they should communicate with the author, Mr. H. E. Morriss, 31, Moray Road, Stroud Green, London, N.]

Mr. A. G. Thornton informs us that, owing to the great increase in the drawing and surveying instrument department of his business, he has removed his factory to larger premises in Bridge Street, Manchester. The extra facilities thus afforded enable him to execute all orders promptly. The office and showrooms, of course, are still at St. Mary's Street, Manchester.

We are indebted to a correspondent (J. H., Fife Keith) for the following extract from *Chambers' Journal*, entitled "A Large Electric Battery":—"The men commissioned to look after the hulls of several ironclads lying in Darsena Harbour, Leghorn, were greatly surprised at a deposit of yellow matter on the bottom of these. On enquiry they found that it was copper, and on looking around for the origin of this they perceived that a few fishing vessels had entered the harbour and had been fastened to the same pillar on the pier by chains, and these having copper bottoms a galvanic action had been set up between the different vessels. The fishing boats were promptly ordered from the harbour, and on refusing to go, the help of the law had to be sought. They were then expelled from the harbour, but not before severe damage had been done to the ironclads by the deposit of copper. No one need be afraid of saying that this has been the largest electric battery ever made (even though by accident)."

Model Engineers and Their Work.—II.

Messrs. T. and C. J. Coates.

(Continued from page 27.)

EA11 boiler consists of a set of "elements" or continuous tubes running to and fro ten times over the fire, always inclining upwards, and finally opening into the "steam collector" which is common to the set; a "feed collector" common to the set connects the lower ends of the elements. The boiler represented has eight elements, but one of these is drawn, with so that its construction and attachments are visible. The straight tubes are of mild steel, 4.5 in. external diameter by 7 ft. long, and are screwed into malleable cast-iron bend or "junction boxes," of which those at the front have hand-hole doors. The junction boxes stand one on another, and the lowest row



FIG. 8.—END VIEW OF MODEL "BELLEVILLE" BOILER.

at the back rest on a roller, so as to permit free expansion.

The feed collector is a square cast steel pipe, into which the lower end of each element is secured; at each end of it is a mud-drum, with a salinometer and a blow-out cock to give a continuous discharge. Each mud-drum is connected to the steam collector by a vertical pipe, through which the water carried over with the steam returns; the steam generated in each pipe circuit passes upward into the collector, carrying much water with it, but the latter is separated by a complete system of baffle plates. Lime water is introduced into the mud-drums with the feed-water in order to precipitate the solid

impurities that would otherwise be deposited in the tubes. Above the left-hand mud-drum is the automatic feed-regulator, controlled by a vertical cylindrical float within a vessel connected by copper pipes with the steam and water spaces of the boiler; to the front of this vessel the water and pressure gauges are fitted.

Above the fire doors runs a square tube or "gas-mixer," supplied with air under pressure which is discharged through a number of nozzles into the furnace to complete the combustion of the gases. Deflecting plates are placed above the tubes to promote circulation of the hot gases, and small deflectors are also fixed to the casing. The grate bars slope considerably, and the furnace is protected round the sides by a firebrick lining.

The doors and the whole of the external casing of the boiler are formed of flanged plates, so arranged as to give stiffness without preventing free expansion. The uptake is similarly constructed, its weight being carried by lattice

is tubular, and has three 2-in. furnaces. It works at a steam pressure of 70 lb. per square inch, the heat being provided by a petroleum spray. The donkey-pump has a steam cylinder $\frac{1}{2}$ in. diameter by $\frac{1}{2}$ in. stroke, and is made to pump water into the boiler or discharge outside. It also serves to circulate water through the condenser tubes while the engines are at rest. This model was awarded a gold medal when exhibited at the Alexandra Palace in 1880, the actual medal being visible in the photograph resting against the engine bed.

A model of quite a different type, but of considerable interest as showing the versatility of the subjects of this article, is that shown in Fig. 9, which is a photograph of a horizontal steam-engine fitted with Corliss valve gear. This model is also to be seen in the South Kensington Museum. The original of the engine represented was made by Messrs. John Musgrave & Sons, of Bolton, for driving a jute mill in Calcutta; its cylinder is 19 ins. diameter by 36 ins. stroke, and the flywheel, which is 12 ft.

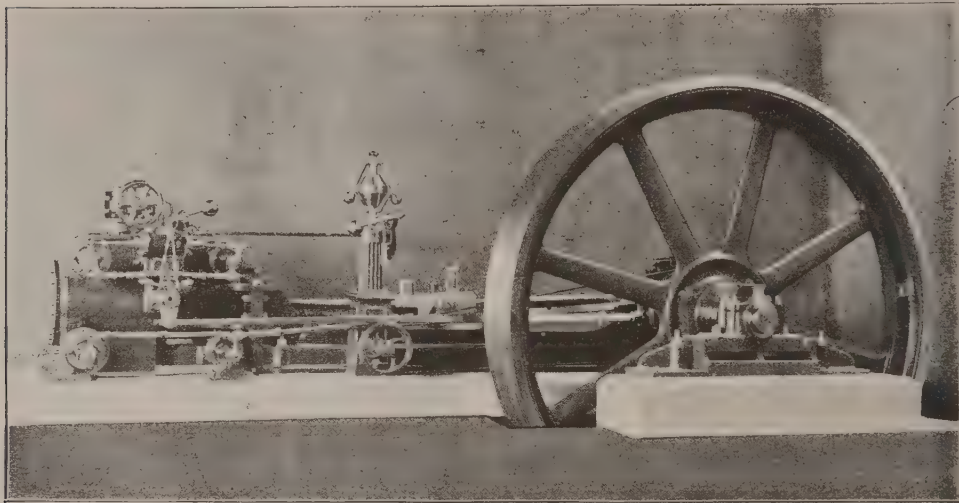


FIG. 9.—MODEL OF HORIZONTAL ENGINE WITH "CORLISS" VALVE GEAR.

girders which rest on four corner columns that constitute the vertical framing of the structure.

The boiler represented has a grate area of 48 sq. ft. and 1,500 sq. ft. of heating surface; it would supply about 10,000 lb. of steam per hour at a pressure of 250 lb. per square inch, or sufficient for over 500 I.H.P.

The model shown in Fig. 4 (see January issue) represents to a scale of $\frac{3}{8}$ in. to the foot the compound surface-condensing marine engines of the steam-yacht "Trave," the property of Consul Reuter, of Lubeck, North Germany. The original engines for this vessel were constructed under the personal supervision of Mr. Thomas Coates by Messrs. Godefroy & Co., engineers and ship-builders, of Hamburg, in 1873. Mr. Coates subsequently acted as chief engineer of this vessel for a period of fifteen months, leaving this post on account of the sudden death of his father. The drawings for the model were made by him while on board, and it took two and a-half years of spare time to complete the model. The diameter of the high-pressure cylinder is $1\frac{1}{4}$ ins., and of the low-pressure cylinder $2\frac{3}{8}$ ins., while the stroke is $1\frac{1}{2}$ ins. The boiler

diameter, weighs 5.75 tons. The power is transmitted from the flywheel by eleven ropes, 1.25 in. diameter, which drive the line shafting of the various floors of the factory. The crank-shaft neck is 7.5 ins. diameter by 15 ins. long, and its bearing is composed of four brasses which can be separately adjusted; the outer bearing of the shaft is, however, of the simple two-piece type.

When supplied with steam at 80 lb. pressure, and running at eighty revolutions per minute, the engine indicates 120 h.p., but when fitted with a condenser such an engine would economically exert 140 h.p.

The valve gear is of the Corliss type and under the control of the governor; it alters the degree of expansion to meet the variations in the load without the intervention of any throttle valve, and, as usually set, the speed does not vary more than 2.5 per cent. from no load to full load. The adjacent diagram shows how the point of "cut-off" changes with the slight alterations in the governor speeds.

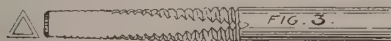
(To be concluded.)

Making Small Tools for Model Work.

By F. J. G.

(Continued from page 28.)

THE other end of the drill must be hardened and tempered in the same way—that is, the back centre, which works against the vice to prevent its wearing away. The ferrule for the bow now only remains to be made. Brass makes the best ferrules, but boxwood does very well. Three-quarter inch is a good size for a 1-16th inch drill. The ferrule is turned up in the lathe, and driven on the tapered portion of the drill. With care, wooden ones may be made without a lathe by means of a pocket-knife and sand paper. The finished drill is shown at B (Fig. 1, February issue).



The smallest drills are all made by the same method, except that it is better to use a holder. They are reduced by filing on a wood block, being held in a pin-vice; they are spread by a tap with a light hammer, filed up, and hardened. But the hardening of drills under 1-64th in. diameter is done differently. It is impossible to plunge such small drills in water hot; they get cold before reaching the water. They are, therefore, "fired." That is, they are held a moment in the flame until red and then withdrawn very quickly with a snatch of the hand into the air with a rush. This cools them so rapidly that it is the same in effect as if they had been hardened in water. To temper these small drills, lay them on a brass plate and heat the plate over a flame until the drills take the required tint; then tip them off quickly before they get hotter.

In the next portion of my article taps for small holes will be considered. For all taps up to 1-16th in. or even 1/8 in. in diameter, the best shape is triangular. They are easy to make, and cut much more freely than square ones. In making small taps, as with drills, the best steel only should be used. Select a piece, or file a piece down in a pin-vice, a little larger than the tap required. Soften it thoroughly in a flame. Then taper it slightly, and file very smooth on a wood block in the vice. Screw it in a pin-vice, and, using plenty of oil, cut a thread upon it with the screw-plate. Do not screw it straight in, but as soon as it goes hard and begins to spring the steel, back it half a turn or so, to ease it, and allow the oil to flow in, advance it a turn, then back a half turn, and so on, until a full thread has been cut for a sufficient length. Now lay it once again on the wood block, and with a smooth, sharp file, file three equal flats upon it the whole length of the thread, making it a trifle tapered, so that the thread just disappears in a knife edge at the extreme end, and a full thread is left for the second half of the tap. File the end off square, and just bevel its three edges. Fig. 3 shows the shape a small tap should be made. This kind of tap is for cutting a thread in a through hole, that is, a hole through which the tap can be passed. For tapping holes in the solid, in which a thread is required to be cut almost to the bottom, the tap must be made differently. In this case the three flats must not be filed up to knife edges, but a full thread must be left to the extreme end, as in Fig. 4. A hole of this sort should always have the thread started by means

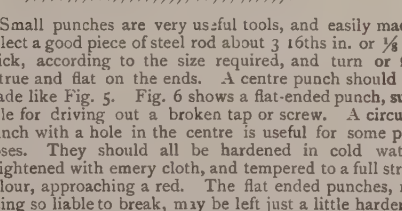
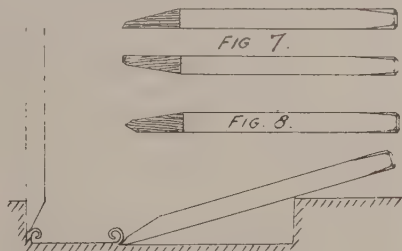
of a taper tap, like Fig. 3, as deeply as possible, and then the plug tap (Fig. 4) used to cut to the bottom.

Harden a tap just like a drill, by heating it in a flame and plunging it into cold water. Brighten the flats by fine emery cloth, and hold the tap over a flame, or lay it upon a small piece of thin sheet brass over a flame until a deep straw-tint appears on the brightened flats. Then allow to cool. A tap should always be tempered a little softer than a drill, as it is subject to a more severe twisting strain in use, and is very liable to break in a hole. When this happens it is usually very awkward, as the tap being hard, it cannot be drilled out. If a tap gets broken in a brass casting, the best way is to punch it out and re-tap the hole a size larger. A flat-ended tempered steel punch will usually drive a tap out and strip the thread in a brass hole with one firm blow of a heavy hammer. But if the method indicated above be observed, of one turn in and a half turn back, with plenty of oil, or, perhaps, in some cases, half a turn in and a quarter turn back, broken taps will very seldom result.

All taps should have a flat filed upon their back ends, with number corresponding to the screw plate, filed or stamped upon them. This may be in Roman figures, which are easily done with a file edge on a flat surface, thus—XII; or for small numbers, such as 2 and 4, may consist of that number of nicks with a file.

Never, on any account, screw a tap into its hole in the plate; both plate and tap are injured in this way, besides the risk of breaking the tap in the hole.

Should a hole in the screw-plate become stopped up by breaking off a piece of brass or steel in it, file it flat on both sides, and start a new drill, smaller than the hole considerably, in the exact centre. Drill it through and drive in a tapered square piece of steel and turn it out. Or, if this fails, open the hole out by broaching, until the threads are reached, when the next can usually be got out by means of a sharp steel point.



Small punches are very useful tools, and easily made. Select a good piece of steel rod about 3/16ths in. or 1/8 in. thick, according to the size required, and turn or file it true and flat on the ends. A centre punch should be made like Fig. 5. Fig. 6 shows a flat-ended punch, suitable for driving out a broken tap or screw. A circular punch with a hole in the centre is useful for some purposes. They should all be hardened in cold water, brightened with emery cloth, and tempered to a full straw colour, approaching a red. The flat ended punches, not being so liable to break, may be left just a little harder.

Observe the shape of the point of the centre punch. It slopes gradually towards the point, ending finally in a somewhat obtuse angle. A centre punch made without the first slope, having the bottom slope continued to the full thickness of the steel, would act just as well, but would have the disadvantage that in use, the exact position of the point, a matter of great importance, could not be very well seen.

All punches should have the tops, where struck by the

hammer, of the shape shown in Figs. 5 and 6, so that the hammer may fall evenly upon the centre of the punch and not on its edges, otherwise it would spring instead of giving a good firm blow.

The main body and top end of a punch should be soft, only the end being hardened. A punch hard throughout injures the hammer face and shivers in use, making the blows upon it uncertain.

It is as useful to have a good set of punches as it is to have taps and drills. A useful set for small model work may consist of one 3-16ths in. centre punch and one 1/4 in. ditto, a set of four flat-ended punches like Fig. 6, from 1-16th in. diam. to 3-16ths in., and a few with central holes of various sizes.

Small chipping chisels are sometimes the only tools which can be brought to bear upon model work, especially in hollows and angles. They should be made from square tool steel, filed up to shape truly and squarely, hardened and tempered to a full straw colour. Figs. 7 and 8 show two useful shapes, and the purposes for which they are used. They are first shaped with a somewhat long bevel, and have a shorter one just at the cutting edge, to make the angle more obtuse and prevent breakage, as shown in the figures. Four would form a useful set, two like each of the figures, made right and left respectively. These small chisels should be sharpened on an oilstone, but the extremely fine and sharp edge should be just smoothed off with one or two light strokes on the stone.

Electrotyping for Amateurs.

By A. P. DRAKE.

(Continued from page 227, Vol. I.)

HAVING now mastered an easy subject, the worker may try his skill on something more advanced—say a fern or other leaf in its natural form and convolutions. Lay the leaf on the hand and brush melted beeswax over the side it is intended to copy. When the first layer is cold, add another, and repeat the process until a block of sufficient thickness is obtained. When the block is quite cold carefully peel off the leaf, and a fine impression will be found on the wax. The block may now be blacklead and wired as before, and an electrotype made from it.

If it is desired to copy both sides of the leaf, proceed as above, only use some freshly mixed plaster instead of beeswax until a sufficient thickness of plaster is formed on one side of the leaf. When the plaster is hard, paint the other side of the leaf with several coats of bisulphide of carbon solution of indiarubber. This is a liquid having a smell like a case of bad eggs all broken at once, so that the best place to perform the above operation is out of doors with the back to the wind. The substance is also very inflammable, so that care must be observed in not approaching too near a fire or light. Next soak a piece of gutta-percha as large as the leaf in scalding hot water until it is soft, and press it on to the newly-painted side of the leaf. When this has set hard, gently pull it off, and we shall have one mould in plaster and one in gutta-percha. If these are blacklead and wired in the usual way, we shall get two electrotypes, one of each side. These are trimmed at the edges, and washed, as in the case of the coin. The above is a method recommended by Mr. M. Roseleur. Another method is to procure a cardboard tray rather larger than the leaf, and half fill it with fine damp sand. In order not to destroy the natural pose of the leaf, we must lay it on the sand, and pack up the hollows under it with sand. When this has been done

satisfactorily, fill up the tray with the plaster paste, and allow to set; then shake off all the sand, but leave the leaf in the mould; well oil the top side of the leaf and the face of the plaster, and again fill up the tray with the plaster. When this is set we shall have two sides of the leaf again in the mould, which may be treated and typed as before.

The above method is used in preparing moulds of seed capsules and small fish such as minnows, only where possible it is best to cut a piece of oiled paper to fit the inside of the tray and round the subject, and place this in position round the acorn, or whatever it may be, before pouring on the plaster. This prevents the sand sticking to the plaster, and also, when operating on the other side, keeps the two blocks of plaster from adhering to each other.

If the subject is not wanted again, the best way to remove it from the moulds is to strongly heat them with the subject inside, and so cause it to shrivel up. If any little bits are left sticking in the mould, they may be removed with a pair of forceps. Should the subject be required again, the two halves of the mould must be carefully separated when dry and the subject taken out. This must be done with great care, or both subject and mould will be spoilt if any little projecting pieces are broken off.

Having now our electrotypes ready for mounting, we must decide on the use we are going to put them to. If the shell is thin, it is best to fill it with solder so as to prevent it being buckled whilst soldering on the back plate. The best way to do this is to use resin as a flux and fill the electrotype with the solder level with the edges. On no account use killed spirits as a flux, as it will in all probability eat through the thin copper in time and destroy it. It is advisable in making copies of seed capsules for hat-pins, or other articles that will be subject to somewhat rough usage, to deposit the copper for two, or even three, days. If this is done, the copies will not require backing up with solder, as the copper will be thick enough to stand fair usage without. When the thin shell has been strengthened with a backing of solder, and the edges trimmed, a back plate—in the case of brooches, tie pins, etc., the same shape and size as the outside edge of shell—is soldered to it. The back plates may be of thin sheet copper, brass or German silver. For small ferns or similar open subjects, an oblong, oval, or other design back plate may be used with the shell soldered in the centre, but for solid leaves a plate to the shape of the leaf should be soldered to the back of the electrotype. Seed capsules for hat-pin heads must be soldered to the pin. To do this, cut off the ordinary glass heel and file or emery paper half an-inch of the end bright and clear; then dip it for a second or two in the outside jar of the cell. When removed, it will be found to be coated with copper. Dry the end and tin it. The pin can now be soldered inside the stem of the electrotype and the surplus solder removed to make a neat job of it. Care must be taken, when soldering up electrotypes, to use no more solder than is required to make a good joint, as the surplus solder has a knack of spreading all over the work and filling up the delicate lines.

The pins and catches for brooches are to be purchased at the local watchmaker's and jeweller's.

As electrotypes in copper look common and soon tarnish, it is usual to either silver or gold plate them. Seed capsules look best gilded, but fish and large leaves are better silvered. If the amateur is near an electroplater's, he can get them done for him as cheaply as if he did them himself; but, as some readers live away from towns, and others prefer to do their own plating, I will in my next article give an outline of the processes used.

(To be continued.)

The Institution of Junior Engineers.

THE fourteenth anniversary dinner of the Institution of Junior Engineers was held on January 28th at the Westminster Palace Hotel, London. As on previous occasions, the fare provided—oratorical, musical and otherwise—was of the best, and the members and friends, numbering close upon a hundred, spent a most enjoyable evening. The occasion was distinctly of a naval character, the room being draped with flags, and the menu card bearing a photograph of H.M.S. "Powerful." The latter we are, by kind permission, enabled to reproduce herewith. The President of the Institution, Sir William H. White, K.C.B., D.Sc., LL.D., F.R.S., occupied the chair, and was supported by the chairman of the institution, Mr. Basil H. Joy, A.M.I.Mech.E., and numerous distinguished guests. Among those whose presence we noted were Sir John Durston, K.C.B., engineer-in-chief of the navy; Lieut. J. C. Colwell, U.S.N. naval attaché, American Embassy; Lieut.-Col. Raban, R.E., director of Admiralty engineering and architectural works; Mr. Chas. J. Owens, general mana-



H.M.S. POWERFUL.]

[Photo by Spooner.

ger of the London and South-Western Railway; Professor W. E. Ayerton, F.R.S., Mr. J. Macfarlane Gray, Professor Spooner, W. Worby Beaumont, M.I.C.E.; Mr. T. E. Gatehouse, F.R.S.E., and Mr. Walter T. Dunn, the indefatigable and ever courteous secretary. In the course of the speeches, allusion was made to the Summer Meeting of the Institution, which this year is to be held in the Southampton and Portsmouth district, and we understand that a most attractive programme of sight-seeing is being arranged for this occasion. To those of our readers who are not familiar with the work of this institution, we may mention that it is intended for promoting the welfare and advancement of the younger members of the engineering profession, and it should be the aim of every apprentice, draughtsman, pupil, or other junior engineer to become a member of this useful body. Monthly meetings are held for the reading and discussion of papers on engineering subjects, and frequent visits are made to important works and factories, where much useful information can be obtained by those interested. Full particulars can be obtained on application to the secretary, 47, Fentiman Road, Clapham, London, S.W.

How to Make a Small Gas-Engine.

By "ATLAS."

(Concluded from page 1.)

ALTHOUGH the foregoing descriptions finished the actual construction of the gas engine, a few hints may be added.

Of course, if the engine runs well at the first trial, no alteration need be made in its construction. To those successful builders I can only say connect the water-jacket to a good size watertank holding about 8 gallons to 10 gallons, using $\frac{1}{2}$ -in. gas barrels and elbows for connections. Have the bottom of watertank somewhat higher than the cylinder. A circular tank about 1 ft. diameter and 2 ft. high will hold 10 gallons.

It is advisable to have a tap in the lower connecting pipe, which will prevent the water running from the tank when the engine is disconnected for cleaning purposes, etc.

The level of the water in the tank must always be above the return pipe, since otherwise no circulation of the water could take place.

See if the water does circulate when the engine has run for two or three minutes. You will be able to judge this by the return pipe getting hot all along its course, since the hot water being lighter, is pressed upwards by the heavier cold water entering the water-jacket from below. If the return water does not get hot it shows that the water does not circulate, in which case introduce a rubber tube in the mouth of the return pipe inside the tank, and draw the water up, when the water will circulate.

Once this proper connection is established, the water will always circulate and keep the cylinder cool enough for working. Make the joints watertight with red lead and linseed oil.

I have before now pointed out the reasons why the engine might refuse to run, and will now give a few details how to overcome the defects.

1. The remedy for a faulty compression is obvious, only you must find out where the compressed mixture escapes.

2. The proper position of the chimney, or rather of the Bunsen burner, must be found by trial; if the engine will not work, *i.e.*, if no explosion takes place, the ignition-tube is heated too high (unless the gas and air is not properly mixed, of which more later). Loosen the setscrew which holds the chimney to the bracket, and lower the burner with chimney $\frac{1}{4}$ in. at a time, until you get an explosion; then fix the chimney in this position permanently. Should an explosion take place before the piston has completed the compression stroke, *i.e.*, should the engine "fire back," then the ignition-tube is heated too low. Raise the chimney till you get the explosions at the right moment. It is advisable to always turn the gas of Bunsen off while these alterations to the height of burner are made, and thus allow the ignition-tube to cool down.

3. The mixture of gas and air should be as 1 to 6, and must be found out by trial. Turn on gas supply tap about three-quarters full and give engine a few turns rather quickly, holding the admission valve open; then let this close up; continue turning the engine. If the mixture is right, and all other conditions fulfilled, explosion should take place and continue doing so at every second revolution. If explosions occur and the engine afterwards stops, not enough gas is admitted; if no explosion takes place, too much gas is drawn in. While the engine is running, open the gas tap a little more, when the power and revolutions will increase, and *vice versa*.

There may be another cause why the engine might not run, and this is to be looked for in the spring which holds the admission valve to its seating. This spring should only be strong enough to pull the valve back against its seating after the piston has drawn in the charge. The compression pushes the valve back on its seating and closes it, the spring only serves to prevent the valve being sucked too far into the gas and air passages. Should the spring exercise a stronger pull it would not allow the valve to open sufficiently, in which case hardly enough gas and air would be admitted into the cylinder. If you are unable to judge the strength of the spring, you could find out whether enough gas and air is being drawn in by the following means:—Put piston of engine in the position which it would take at the beginning of its first or intake stroke; draw in gas and air, *i.e.*, make the first stroke; open the exhaust-valve by pushing the exhaust-valve stem in; apply a lighted match to the mouth of exhaust-pipe and turn the spindle back, which causes the piston to push out the charge through exhaust-pipe. If this charge lights up you get sufficient gas and air through the inlet valve. If not the spring is too strong, and must be weakened by cutting off one or two spirals.

For lubricating the piston good thick gas-engine oil should be used, and the oil-cup on the cylinder should never be empty while the engine runs. A cap on this oil-cup will prevent any dust or grit getting into the cylinder. Ordinary machine oil is used for the other moving parts of the engine. See that the bearings for spindle and disc pin do not get hot during the working, which could be obviated by slackening the screws which hold the caps, &c. For driving dynamo, or fan, or other machinery where high speed is required, drive by means of round gut hook and eye direct from flywheel. An arrangement for tightening the gut when engine runs at desired speed, must be made in the shape of a sledge. A flat piece of board with parallel guides in which slides dynamo, &c.; at one end a circular disc of box or other hard wood is fixed by means of roundheaded screw, on which the disc turns, the hole for screw being between the centre and edge of disc, which gives the eccentric motion. By turning the disc the dynamo, &c., will be pushed forward and the driving band tightened.

For lathe and other low speed work, a separate pulley must be keyed to the spindle on either side of flywheel, and the size of this pulley depends on the speed required; a 2 in. to 2½ in. diameter pulley will be found suitable for most purposes. Use a thin flat belt to drive from this pulley.

The engine is constructed to run in the usual "forward" direction. Should it be absolutely necessary to run the engine "overhand," a second hole must be drilled and tapped in the disc, exactly opposite the other hole. The disc-pin must then be screwed into this hole, which is all that is required for reversing. The engine should be cleaned after ten to thirty hours' run. The asbestos rings in piston may want seeing to, as the heat and constant friction wears them considerably.

If piston rings are prepared by more advanced amateurs, they should be put in one by one, *i.e.*, run engine with two asbestos rings, and one steel or cast iron piston ring, and let the latter wear thoroughly into shape before putting in the second, and so on. If you were to put the three piston rings in from the start, the friction would be so great as to prevent the piston from moving, nor would you get any compression at first. Those who use piston rings need hardly be told that they should work in stop pins to prevent their frame turning round on the piston.

The engine should be painted in any colour used for machinery, and dark green is, to my idea, the most suitable shade.

A silencer may be introduced to silence the noise of

the exhaust strokes, and will be found a great boon to those who work their engine in the house. It consists of an iron pot or tin, holding about ½ gal. The exhaust-pipe is screwed into this pot at its lower end; another pipe is screwed in at its upper end, and let out to the chimney. The inside of the pot is fitted with pebbles of the size of a threepenny-bit, or small marbles may be used. The pot must then be closed airtight. These small stones break up the exhaust into innumerable small parts, by which the force of it is lost, and consequently the noise deadened.

I hope, in conclusion, that the foregoing description has made clear to many the working of a gas-engine in a general way. Larger engines possess special timing valves, governors, etc., but the principle on which they work underlies also this small gas-engine. I called it a 1-6th b.h.p., though I might have said ¼ h.p., but much depends on the state of compression and working parts, and I thought better rather to understate than to overstate the possible power of engine. Those who have followed its construction, and made the engine, will by now feel vastly repaid by the success of their work.

Jottings.

THE Marconi system of wireless telegraphy underwent a successful trial at the South Foreland lightship recently, in the presence of a number of local governing representatives. Satisfactory results were obtained between the East Goodwin lightship, twelve miles out to sea, and the lighthouse. The height of the pole used for transmission was 130 ft., and Signor Marconi considered that by this a message could be sent to the French coast. The receiving wire on the lightship was run 80 ft. up the mast. During the recent severe weather the system has worked perfectly, and the men on the ship have sent messages that have been transmitted to Ramsgate.

Mr. N. P. Melnikoff, the editor of the Russian journal, *Technologue*, published at Odessa, has, we understand, made a little model of an engine which depends for its motive power upon the fermentation of bacteria. Although the engine in itself has no practical value, it nevertheless furnishes an interesting example of the power which can be derived from fermenting bodies. The inventor states that, if the fermenting vessel containing the bacteria be large, and the engine cylinder be correspondingly proportioned, enough power can be obtained to operate an engine uninterruptedly for twenty or thirty hours. The fermentation of different bacteria will give different results, the power produced depending upon the quantity of carbon dioxide or other gases generated by each species of bacteria.

A most interesting and ingenious machine, named the "Viagraph," has been invented by a gentleman in Ireland. It is intended to record the unevenness of any surface that is passed over, and this it does with complete success, according to a definite scale. The result is that the surfaces of various stretches of highway may be compared. The inventor lectured on the subject at Belfast, and showed, among others, diagrams of the surfaces of the Leatherhead to Guildford road and of the Belfast to Lisburn road. The unevenness of the former was only 12 ft. to 14 ft. per mile, and of the latter 114 ft. per mile.

The Society of Model Engineers.

THE usual monthly meeting of the Society of Model Engineers was held at the Memorial Hall, Farringdon Street, E.C., on Wednesday, February 1st, about sixty members and friends being present. A large number of models were exhibited, and much interest was manifested in them. The following may here be mentioned:

THE CRYPTO WORKS COMPANY sent two dynamos, one being a 50 watt (No. 5), and the other a compound-wound (No. 2 type). The latter was fitted with one of this firm's epicyclic hand-driving wheels, with internal gearing, similar to that used in the construction of their well known cycles. By this means one revolution of the handle gave about $3\frac{3}{4}$ revolutions of the big driving wheel, so that speed was easily got to drive a small dynamo. A complete set of rough parts for the 50-watt machine was also shown.

Messrs. J. T. MAYFIELD & Co. lent one of their "Dynolite" cycle lamps, which is worked from a small dynamo with permanent magnet. The exhibit attracted much attention by its neatness.

Messrs. WHITNEY exhibited several of their model pumps—namely, duplex, vertical, direct acting horizontal, and horizontal flywheel types. In a note attached to the models it was explained that all these pumps were made with the same size steam cylinder, viz., $\frac{1}{2}$ -in. stroke, $\frac{3}{8}$ -in. bore, and they have been extensively used for boiler feeding, model fountains, fire engines, &c. By means of a rubber ball and tube supplied, the working capabilities of these well-made models was practically demonstrated.

The chair was taken by Mr. Percival Marshall at 8.15, and after formal business had been disposed of, the chairman called attention to the fact that the Library would start on Monday, February 6th, a number of names having already been entered for books. The Library rules were also read and confirmed. (In connection with this, we have to announce that Mr. S. McArthur Fowler has presented the following books to the Library: Ayrton's "Electricity" and Bonney's "Electrical Experiments." Messrs. Whittaker & Co. have also presented Farman's "Auto Cars," "Engineer Draughtsman's Work," Horner's "Metal Turning," and "The Principles of Fitting.")

Mr. J. C. CREBBIN was next called upon to give the report of the sub-committee appointed to decide on a standard gauge for model locos. Mr. Crebbin stated that, after a long discussion, the committee had come to the conclusion that a gauge of $3\frac{1}{2}$ ins. would be the most desirable for small models of $\frac{1}{2}$ in. or $\frac{3}{4}$ in. scale, as that would allow an engine to be made large enough to steam well in the open air, while it would be small enough to take sharp curves in a large room. Such a gauge would work out to about $3\frac{1}{4}$ ins. between the flanges. It was also thought desirable to recommend the adoption of a gauge of 5 ins. by those wishing to build 1-in. scale models.

The finding of the committee was warmly applauded by the meeting, and their recommendations unanimously adopted. The Chairman then called upon

Mr. J. SMART, who described and exhibited an excellent milling appliance for the lathe. Specimens of work done in this machine were passed round and attracted much attention. We hope to be able to publish in the next number an illustrated description of Messrs. Smart's appliance.

Mr. SOLOMON next entered upon a description of his model locomotive, "Doris," which, he explained, was built

after the pattern of Stephenson's long-boiler engine of 1846. The model is fired externally and steams well.

Mr. BLANEY, whose sense of humour added point to his remarks, exhibited and described a clever lathe-head made out of an old rotary shuttle sewing machine. Mr. Blaney, in the course of his speech, laid stress on the advantages of the use of lead, his contention being that it was a far more useful and easily wrought material than amateurs generally condescended to think it.

Mr. HILDBERSLEY, who had with him a fine model yacht, explained that it was a model 20-rater, the length on L.W.L. being $33\frac{1}{2}$ ins.

A fast model torpedo boat destroyer, which was also exhibited, is described elsewhere in this issue.

Mr. PEARCE had a 14-in. spark induction coil, and next proceeded to give a display of experiments with it. The current being derived from a Crypto dynamo driven by hand, experiments were shown with vacuum tubes, etc., the tubes being rotated by a small electromotor. Mr. Pearce stated that his coil had two layers of No. 18 for primary, and 2 lbs. No. 36 for secondary, and was usually worked with three bichromate cells. It was fitted with the usual reversing commutator.

IMPORTANT TO COUNTRY MEMBERS.

Model engineers resident in provincial towns, who may be thinking of joining the society will be interested to learn that a circulating portfolio has been instituted for their special benefit. Full particulars of this, and of other advantages which isolated amateurs may obtain, by becoming members, can be had by addressing a postcard to the hon. secretary, Mr. Herbert Sanderson, "The Mount," Ealing, London, W.

LIBRARY RULES.

The following are the rules governing the issue of the books now in the Society's Library:

1. Books may be borrowed or consulted by members of the Society by applying to Messrs. Dawbarn & Ward, 6, Farringdon Avenue, E.C., between the hours of 9 a.m. and 6 p.m., and the membership card must be produced in either case. Members taking books away must sign their names in a book kept for the purpose. This signature shall be regarded as sufficient evidence that the borrower continues to hold the book in his possession, and it will be duly cancelled on the return of the borrowed book. Borrowers will be held responsible for any books in their possession, and will be liable for any damage or loss.

2. Books may be borrowed for one week by London members, and for ten days by provincial members. A fine of 3d. shall be levied for each week, or part of a week, the book is retained beyond the allowed period.

3. No member shall be allowed to have in his possession more than one book at a time; and if several members require the same book it shall be issued to each in turn in order of application.

4. All members borrowing books through the post shall be required to pay the postage both ways.

5. All communications concerning the Library should be addressed to the Librarian, Society of Model Engineers, 6, Farringdon Avenue, E.C.

THE NEXT MEETINGS.

The next meeting of the Society will be held at the Memorial Hall, Farringdon Street, E.C., on Thursday, March 9th, at 7 o'clock. Mr. Stanley J. Harding has kindly promised to give a short lecture on "The Wimsurst Machine," to be illustrated with some very effective and interesting experiments. Mr. J. C. Crebbin will show a model of a six-wheel single broad gauge locomotive with four wheel tender. The engine has Gooch valve gear, and is adapted for either methylated spirits, coal, or oil fuel. The gauge is 5 ins. Mr. A. M. H. Solomon will also show his model locomotive the "Bessborough."

and Messrs. Whitney have promised to lend an interesting model of a L. & N.W.R. locomotive.

The meeting after the above will be held on Friday, April 7th, and further particulars will be announced in due course.

PROVINCIAL BRANCHES.

Mr. A. P. Drake, 4, Balfour Street, Bradford, writes us that he is willing to undertake the formation of a branch for the Bradford district, and invites those who are interested to attend a meeting at the address given above on Wednesday, March 8th, at 7.30 p.m. In addition to discussing the formation of the branch, he will read a short paper on the subject of "Small Accumulators." He would be glad to have suggestions from intending members as to a suitable place for holding regular meetings nearer the centre of the city.

Mr. B. Shaw, 31, Catherine Road, Sheffield, will also be pleased to hear from readers in his district with a view to forming a branch. He has presented a photograph to the London Society, showing a view of his workshop containing many interesting models, and this was exhibited at the February meeting reported above. Mr. Shaw is willing to place his workshop at the disposal of the members until a more suitable meeting place can be found.

Mr. W. W. Burtonwood, 47, Walnut Street, Hulme, Manchester, writes that he has had several responses from local amateurs interested in forming a Manchester branch, but that he requires more members to come forward to enable a proper start to be made. Will Manchester readers kindly note?

Mr. H. E. Wilkinson, Bexley Avenue, Roundhay Road, Leeds, reports that the Leeds Branch of the Society is making good progress, several new members being enrolled at the meeting on February 2nd. The next meeting will be held at The New Waverley Hotel, Call Lane, Leeds, on March 2nd, in conjunction with the members of the Leeds Model Yacht Club, when the desirability of amalgamating the two Societies will be finally discussed. Several offers of models, books, etc., have already been made by members, and one gentleman has promised the use of a 6 in. back-gear screw-cutting lathe to any member requiring such a tool for his work. Owing to the illness of the secretary, communications should at present be addressed to Mr. Wilkinson as above.

COMPETITIONS.

We are pleased to be able to announce that the committee have decided to offer prizes, probably in the form of gold and silver medals and diplomas, for the best models made by members of the Society, and to arrange for an exhibition to be held at which the competing models will be on view. As these competitions will only be open to regular members of the Society, we would advise those readers who have not yet joined, and who have any idea of competing, to make application to the secretary without delay. Further particulars of the competitions will be announced at an early date.

For the Book-shelf.

[Any book reviewed under this heading can be obtained from THE MODEL ENGINEER BOOK DEPARTMENT, 6, FARRINGTON AVENUE, LONDON, E.C., by remitting the published price and cost of postage.]

GAS AND PETROLEUM ENGINES. Edited by A. G. ELLIOTT, B.Sc. London: Whitaker & Co., 2, White Hart Street, Paternoster Square. Cloth bound. Price 2s. 6d.

In this work a very large number of gas and petroleum engines of varied types are passed under review, from the earliest to the most recent times. As the book is very

fully illustrated, and carefully indexed, it should prove of much value as a handy reference volume, in which the peculiarities of almost any known type of gas or oil engine may at once be found. The ground covered includes not only the tabulation of existing engines, but also an interesting chapter on the working principles of gas engines (treated in a sufficiently popular manner), and others on gas generating plant and the maintenance of gas and petroleum engines. We note a couple of errors which have been allowed to creep in, one on p. 77, where petroleum oil is stated to be less dangerous than spirit, owing to the lower flashing point of the former; the flashing-point of the petroleum is, of course, higher than that of spirit. The other is a misprint relative to an illustration on p. 92, "page 91" being evidently an error. No doubt corrections will be made in future issues of the book, which we recommend as an excellent addition to the amateur's library.

MACHINE DRAWING. Book I. By T. and T. G. JONES.

Third edition. Cloth, limp. 3s. net.

MACHINE DRAWING. Book II, Part 1. By T. and T. G. JONES. Cloth, limp. 2s. net. John Heywood,

Deansgate and Ridgefield, Manchester; 29 and 30, Shoe Lane, London, E.C.

It would be difficult within our limits to express our appreciation of these works. Primarily intended for the use of engineering students in science and technical colleges, they are so thorough and well arranged that they should be in the hands of all connected with engineering draughtsmanship. The examples are well selected and well drawn. Every plate is accompanied with descriptive letterpress sufficiently explanatory without unnecessary wording, and every drawing is a very model in completeness of dimensions and setting out. The specimens of each class of engineering chosen are also, on the whole, representative of the best practice, the only fault we have to find with this being the drawing of hydraulic snug for cast-iron pipes in plate XI., a true ellipse being much stronger (and more common practice) than the form shown. Book I. deals with plane and solid geometry, details of numerous machines, locomotives, and steam engines. Book II. has complete and detail drawings of drilling, planing, slotting, and shaping machines and forms of gearing. Both can be recommended with the greatest confidence.

THE PRACTICAL ELECTRICIAN'S POCKET-BOOK AND

DIARY. Edited by H. T. CREWE, M. I. Mech. E. 1s. net. S. Rentell & Co., 11, Ludgate Hill, London, E.C.

This little work has been issued to supply electricians with a practical pocket-book and diary on the lines of the well known engineers' annual pocket-books. It is well printed on thin paper—almost too thin, though this is necessary for portability—and contains a mass of well-arranged information suitable to working electricians, dynamo attendants, engine users, and others. The diary space is somewhat limited, but we have no doubt the book will have a sale sufficient to justify the enterprise of its publishers in developing a new field.

THE SLIDE RULE. By ROBERT GORDON BLAINE, M.E. London: E. and F. N. Spon, Limited, 125, Strand, W.C. 2s. 6d.

Mr. Blaine, in the preface to this little book, remarks on the difficulties so many users of slide-rules constantly meet, owing to the fact that they learn the use of the rule by rote, and without a proper perception of its underlying principles. This knowledge the author has it in his intention to impart, and within his limits, does his work very satisfactorily. Mr. Blaine's volume may be warmly commended for his clear explanations on the use of the rule, and the large number and varied nature of examples given.

The Editor's Page.

WE have had intimations from several readers that more articles and notes on the subject of model yachting would be appreciated. Indeed, it has been suggested that during the summer months it would be a good thing to run a model yachting supplement in THE MODEL ENGINEER, such supplement not to occupy any of the existing space to the curtailment of mechanical and electrical matters, but to consist of extra pages. The proposal is that it should contain practical articles on the building and sailing of model yachts, and also reports of the races and doings of the various model yacht clubs in different parts of the country. We should like to hear other readers' opinions on this proposal, and shall therefore feel obliged if those interested in the subject will take the opportunity of sending us, on a post-card, a few lines expressing their views. If a sufficient number of readers favour the project, we will go into the matter and see what it is possible for us to do.

On February 28th, that is three days after the appearance of this issue, our Prize Competition No. 5 closes. Intending competitors should therefore send in their MSS. and drawings without delay.

Mr. J. E. Marshall, Bradford, New Hampshire, U.S.A., asks us to state that he is desirous of corresponding with English readers of THE MODEL ENGINEER with regard to matters of mutual interest in connection with the making of all kinds of models and electrical apparatus. He is anxious for information on English types of models and apparatus, and will be pleased to impart in return particulars of the methods of model makers in America. He would also be pleased to exchange catalogues, papers, etc.

"W. A. S." (Bridgwater) sends us some photographs of his workshop, and some of the models he and his chum have made. He also writes a chatty little account of his work, but as this is marked "private," we presume it is intended for the editorial eyes only. We are sorry the photos are not sufficiently clear for reproduction in our pages, but we are none the less pleased to hear from our correspondent, who, though only 15 years of age, appears to have made considerable progress in the model-making art. We are always glad to hear of the doings of M. E. readers.

A Peterborough reader sends us a cutting from a newspaper giving particulars of a recent case in the Law Courts, where a local engineer claimed against the Midland Railway Company for damages to some models sent by train from Peterborough to Leicester. It appears that the models were placed in a glass case, which was packed in a specially constructed box labelled on the outside, "Glass—with Care, Brittle Goods," &c., but when unpacked at Leicester were found to be practically wrecked. One of the models, a marine engine, had taken the plain-

tiff twenty-two hours per week for ten years to make. The models were insured for £25, and the damages claimed were assessed at £46 10s. The railway company denied liability. After hearing evidence on both sides, the judge said that he was of opinion that the packing was insufficient, and that such an accident might have happened without negligence on the part of the company. The action would, therefore, be dismissed without costs.

Commenting on this case, our correspondent writes:—"I may add that the principal model, a handsome piece of work, consisting of a double cylinder compound marine engine, obtained the Hornsby Silver Medal at the Grant-ham Exhibition in 1898, and is of exceptionally good workmanship. The outer box was furnished with handles at each end for lifting it, and it was insured for £25, and the insurance coupon placed outside the lid of box. As stated in the report, upon the goods being returned the man asked for compensation from the railway company, his silver medal and other exhibits being in the case and damaged. His claim was, however, repudiated by the railway company, who admitted no liability, and the man was therefore compelled to employ a solicitor to endeavour to get him some recompense. The decision of the case has caused some amazement, His Honour stating such goods should be packed by a professional packer. Now, Sir, I venture to think a great injustice has been done, and an important issue is involved in this decision if allowed to go unchallenged, for, if insured goods are not eligible for recompense in case of injury, what protection has any one of your numerous contributors, readers, and model engineers, who are invited to send their valuable goods to exhibitions at a distance. The fact of the insurance having been accepted, in my opinion holds the railway company liable, and they actually paid £8 into court prior to the trial, thus acknowledging their liability (this amount was withdrawn after the case was decided). I trust, in the cause of justice, you will make what use you think well of this communication, so as to obtain an expression of opinion from those qualified to give advice." We do not ourselves feel competent to express an opinion as to the legal aspect of the question raised in the foregoing case, but we shall be pleased to hear from any of our friends who are better versed in the intricacies of the law. The subject of the safe packing of valuable models for transit by rail is one of much importance to readers of this journal, and we will willingly accord space in our columns for its full discussion.

"G. E." (King William's Town, South Africa) writes:—"In forwarding my subscriptions for the next two years to your publishers, I take the opportunity of congratulating you on the completion of the first year of your little paper. It must be exceedingly gratifying to you to know how 'COMPLETELY' it has filled a long-needed want. I personally can assure you that it is with the greatest pleasure that I receive my copy every month. Fellows are not scientific here, I regret to say, but I have managed to get our local machinist to order the

paper, and I enclose his subscription also. Wishing you a continuance of your well-deserved success."

In consequence of the numerous applications received by our publishers for back numbers of THE MODEL ENGINEER, they ask us to state that the whole of the 1898 numbers are now out of print, with the exception of a very few copies of the March and December issues. The bound volumes were also all sold within a few hours of publication. Cloth binding cases and cloth reading cases can still be had; price, 1s., post free, 1s. 3d. each

New Prize Competitions.

COMPETITION No. 6.

A PRIZE OF £2 2s. is offered for the best article on "HOW TO MAKE A MODEL ELECTRIC MOTOR CAR."

This should be accompanied by complete working drawings, showing the construction of the body and wheels of the car, and also the details of the motor, accumulator, and gearing, etc.

The closing date for this competition is April 30th. (See General Rules.)

COMPETITION No. 7.

TWO PRIZES OF £1 1s. each are offered for the best descriptions of how to make a working model suitable for driving from a small engine or gas engine, or electric motor. The model described may be a miniature machine tool, crane, pump, or agricultural machine, printing press, or any mechanical model with which the competitor is familiar. Full working drawings should accompany the description.

The closing date for this competition is June 30th. (See General Rules.)

GENERAL RULES.

The following rules apply to all of the foregoing competitions:—

(1.) Any reader may enter for each and all of the competitions, but each article, with its drawings, should be sent under separate cover, and should be marked on the outside with the number of the competition to which it belongs.

(2.) All articles should be clearly written on one side of the paper only, and should bear the full name and address of the sender.

(3.) All drawings should be made in Indian ink on white cardboard, and should show all necessary dimensions in plain figures. No coloured lines or washes should be put in. Each drawing should bear the full name and address of the sender on the back.

(4.) Competitors desiring their work returned, in the event of it being unsuccessful, should enclose stamps for that purpose.

(5.) The Editor reserves the right of printing any of the unsuccessful competitions which he may consider worthy of publication.

(6.) All competitions should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.

(7.) The Editor's decision must be considered as final.

Experiments were recently made on the line between Brussels and Ghent to test the speed of the new Scotch locomotives now in use on this section of the line. An engine drawing eight heavy coaches covered the distance in 40 mins., beating all previous records with Belgian engines by nearly 2mins.

Practical Letters from Our Readers.

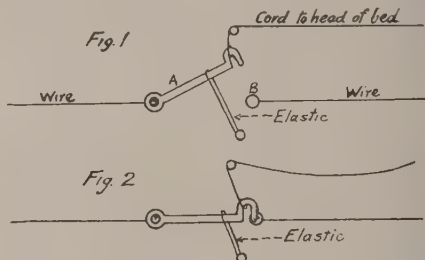
[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.]

Electric Clock Alarms.

TO THE EDITOR OF *The Model Engineer*.

SIR,—In the last two issues of your champion little paper, I have noticed articles on Electric Clock Alarms. I have gone a little further, and devised an arrangement as follows:

To the switch A I have attached an elastic band (which can be detached) to pull it on to the contact B. To the top of switch a cord leads to the head of bed. When



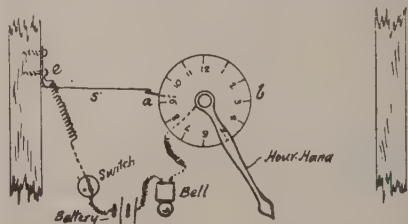
the alarm goes off, a pull on cord lifts the switch off, and by retaining the hold on cord, is kept off. But the moment I fall asleep again my fingers relax their grip on cord, which allows the elastic to pull the switch on to contact again, whereby the bell rings a second or third time *ad lib*.

Perhaps there are others as fond of their "few minutes" as I, who would be glad of such a contrivance.

Apologising for bringing up the subject of Clock Alarms again,—Yours truly,
C. H. G.
Manchester.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Being a reader of THE MODEL ENGINEER, I have been interested with the descriptions of various alarm clocks given by your readers. I have myself made one which differs from any I have seen described. The clock I used was an old American alarm clock in



wooden case, in which the spring which worked the hammer of the gong was broken, and therefore useless.

On the hour spindle is a brass disc (b) with the hours 1 to 12 marked on. This disc can be turned round on the hour spindle. On the back of the brass disc I soldered a

piece of stiff copper wire (*a*) about 16 S.W.G. On the side of the clock case (*c*) I screwed a piece of spring copper (*s*), about $\frac{3}{8}$ in. wide, and long enough to just overlap the piece of wire.

The diagram shows the alarm set for 5 o'clock. It will be noticed that the wire *a* is just making contact with *s*. As the clock goes round the wire *a* pushes forward *s*, till it finally breaks contact after an interval determined by the amount *t* is allowed to overlap *a*. To set the alarm for any other hour, all that is necessary is to turn the disc *b* round till the hour at which you desire it to ring is directly beneath the hour hand, whatever the position of the latter may be. One wire is fastened under a screw at *e*, and the other to some metallic part of the clock. The other connections are as shown.

In reply to "Examiner" in the February number, I think he is mistaken about the works of his clock becoming magnetised. The majority of clocks have wheels of brass, which I always understood was non-magnetic, in addition to which there is nothing to produce magnetism, and therefore the clock could not be affected as he imagines. The alarm I describe above has the current passing through the works of the clock, and up to the present time (after seven months' working) has not been affected in the least.—Yours truly, J. H. Bradford.

Reversing Gear for Oscillating Cylinders.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I enclose sketches of a simple reversing gear for a pair of oscillating cylinders, 1 in. stroke and $\frac{1}{2}$ in. bore. I came across it in an engine I was overhauling, and sent it along, thinking it would be of some use to the readers of *THE MODEL ENGINEER*. The gear was simply an ordinary plug tap, altered to the sketches. Diameter of plug, $\frac{3}{8}$ in.; steamways in plug, about $\frac{1}{2}$ in. diameter. Fig. 1 shows position for "ahead," and

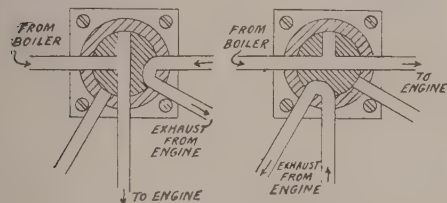


Fig. 1.

Fig. 2.

Fig. 2 for "astern." A careful study of the sketch will show how this is effected. The plug of the tap has a hole drilled at right angles to the hole which is in the plug in the first instance, and a small groove is cut for the exhaust connection. This tap is very easily made, and will be suitable for either locomotive or steamboat, a quarter turn of the handle being enough to reverse the engine. It would be advisable to use a couple of stop pins to prevent the handle being moved too far either way.—Yours truly, A. P. D. Bradford.

The Patent Office Library.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Speaking to one or two members at the last meeting of the Society of Model Engineers, I was much surprised that so many members seem to know so little of the Patent Office Library in Bishop's Court, Chancery Lane. As to give a list of the papers would take up a whole issue of *THE MODEL ENGINEER*, I will briefly

say that with regard to weekly papers there are *Engineer* and *Engineering*, whose pages would furnish amateurs with valuable working drawings for models, the *Railway Engineer*, and various electrical and other scientific weeklies. As far as regards American papers, there are the *Railroad Gazette*, *American Engineer*, *Locomotive Engineering*, and electrical papers, and also, last, but not least, the Scientific American supplement, which gives many valuable articles on making dynamos, batteries, lathe, forge, &c. As the library is open from 10 to 10 every day, and is free, I think members should know of this valuable place.—Yours truly, A. M. R. Harlesden, N.W.

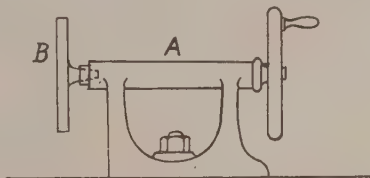
Small Tools for Model Work.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I notice, in your February issue, an article by "F. J. G." on making small tools for model work.

I beg to submit a better method of hardening small drills, viz.:—Heat the drill to a red heat at the point, and plunge it into an ordinary paraffin-wax candle.

No tempering will be necessary, as this method gives just the requisite hardness.



The accompanying sketch shows a useful attachment to enable drilling to be accurately done in the lathe.

A represents the loose headstock of a lathe with the centre removed, and a circular face-plate (B) with a tapered plug on the back, which fits into the hole left by the removal of the centre.

The drill is held in a suitable chuck, and the work to be drilled is bolted or held against B, the feed being given by the hand wheel.—Yours truly, S. C. Middlesbrough.

TO THE EDITOR OF *The Model Engineer*.

SIR,—A better plan than that given by F. J. G. (if a very mild form of amateur may give a suggestion) is to lay the drill, after brightening it, on a piece of sheet iron over the gas flame, and, as soon as the right colour is obtained, roll it off into oil. The sheet iron hides the flame from the eyes, and gives a better opportunity of judging of the colour, and, as the heating is more gradual, there is not so much chance of overdoing it and getting the temper too soft. This hint was given me by an old engineer, and I have found it very successful.

Portsmouth.

T. M.

A Simple Water Motor.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Re J. P. F.'s letter in No. 14 of *THE MODEL ENGINEER*. He omits to mention anything about bearings for the axle of the water motor. I should suggest a pair of brasses (those used for the ends of window blinds to run in, would do) screwed to the opposite sides of box. If $\frac{3}{8}$ in. holes were cut in the latter to coincide with holes in bearings, there ought to be plenty of room to allow the wood to swell without binding the axle. A loose box of wood or tin to fit over the top of wheel, would also be an improvement, as the high speed at which the motors generally run always splashes the water about.—Yours truly, W. H. Leominster

Calibrating Voltmeters.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—“Voltmeter’s” letter had escaped my notice. If he will carefully read my article, he will notice that I do not expect the two instruments to give the same deflections; it is not needed.

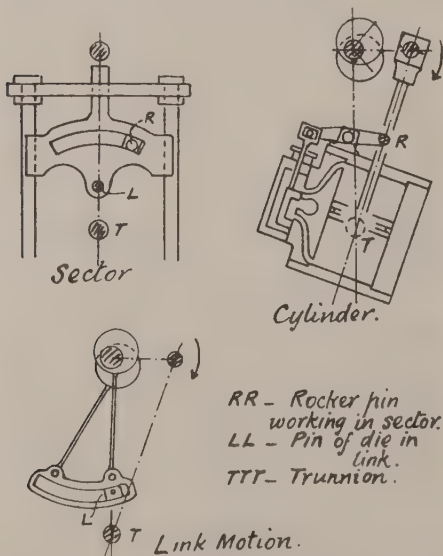
I am much obliged to “Amateur” for his reply to this letter.—Yours truly,
“ZODIAC.”
Manchester.

Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, FARRINGTON AVENUE, LONDON, E.C.]

The following are selected from the queries which have been replied to recently:—

[598] **Force Pump for Model Boiler.** F. S. (Rye) writes: I have a model boiler, 1 ft. by 2 ft., working pressure 60 lb.; to this I want to fit a force pump. Would you tell me, should the water be forced into the boiler above or below the water-line? Also, can I put link motion reversing gear to double-action oscillating cylinders? If so, how? A rough sketch would greatly help.



Water should enter boiler as near the bottom of water space and as far from firebox as possible. To apply link motion reversing gear to oscillating cylinders they must have a valve chest fitted between the trunnions, similar to that in a slide-valve cylinder. The link motion is of the ordinary pattern, with two eccentrics on shaft and the link connected to reversing lever as usual. The die in the link is connected by a pin to a sector working between two guides, with a central vertical rod, also working in a guide; the slot in the sector is concentric with the trunnions when the slide-valve is in mid-position. This and the link motion do not oscillate with the cylinder. To transfer the motion from sector to valve spindle, a rocking shaft is fitted at a point half-way between centre lines of cylinder and valve spindle; one end of rocker carries a die working in sector as the cylinder oscillates, the other end is connected to valve spindle. The steam to and from valve chest must pass through trunnions.

[599] **Soldering Zinc.** W. O. (Market Drayton, Salop) writes: I am constructing the bichromate battery described in No. 1 of *THE MODEL ENGINEER*, but I find I cannot solder the wire from the copper on to the zinc plate, as directed in the article. It will not take “hold” on the zinc, but falls off every time. I am at a loss to know how to join the elements together, as this method has failed in my hands. Please advise me. (2) Where can I obtain Prout’s elastic glue?

(1) Zinc is a troublesome material to solder. Use chloride of zinc (“killed spirits”) as flux, and a big soldering iron, which must be well heated and tinned. If you cannot manage the soldering, cut a strip of thin brass and clamp it between the zinc plate and the wood insulators. A wire can then easily be soldered to the brass slip, and though not so thorough as the alternative method, will do very well. (2) You ought to have no difficulty in obtaining Prout’s elastic glue. In London almost every oilman, and electrical or gas-fittings dealer supplies it. Try similar shops in your own town.

[600] **Loco-Type Boiler.** F. R. (Wellington) writes: (1) Will a boiler of the loco. type, with a firebox 6 in. square outside and 5 in. square inside, also a barrel 13 in. long, with $\frac{3}{4}$ in. taken out for smokebox, and twelve 5-8th in. tubes through, with chimney, 12 in. bottom and 12 in. top, be large enough to drive a double cylinder engine; cylinders 12 in. bore and 2 1-8th in. stroke? (2) Shall I be able to keep up 70 lb. steam, and keep the pump on when necessary with charcoal? (3) Can I make the boiler in one piece, or make the tubes water-tight than expanding them, or is it almost impossible to do that in such a small firebox? (4) Where can I get best charcoal sheet iron; also, what thickness ought I to have to test to 200 lb. per square inch? And if the sizes are not right, will you kindly give me right ones, but as small as possible, as I want it to look in proportion with the engine, which is horizontal? What pressure will a hopper stand with all joints in the top?

(1) It would be advisable to enlarge the boiler slightly by making firebox 8 in. long outside, and 7 in. long inside; barrel of boiler, 6 in. diam. and 15 in. long, including 3 in. for smokebox. The 5-8th in. tubes will require a sharp draught, which will be obtained by turning exhaust steam up chimney; the latter should be $\frac{1}{2}$ in. to 12 in. diam. (2) Probably. (3) Tubes can be soldered into tube-plates. (4) Nearly all metal warehouses keep charcoal iron. For a working pressure of 70 lb., a thickness of 3-32nds in. will answer; it is not necessary to test higher than 100 lb. Brazed joints in copper about the same strength as riveted.

[607] **Faulty Dynamo.** R. C. A. (Sheffield) writes: I have made a dynamo with a Siemens’ armature 3 5-8 in. long by $\frac{1}{4}$ in. diam., the web being $\frac{3}{4}$ in. wide, $\frac{1}{2}$ in. long, by $\frac{1}{2}$ in. thick, and is filled with No. 20 D.S.C.C. wire. The legs of field magnets are $\frac{1}{2}$ in. thick by 4 in. wide, and are wound with 40 strands of No. 16 C.C. wire, about 6 lb. being used. The dynamo is supposed to light four lamps of 5 c-p., each 8 volts, but does not light one properly, for as soon as the light gets about full power the magnetism appears to stop the armature, the light going out in consequence. The armature runs nice and close to the poles, but does not catch anywhere. Can you tell me what is wrong, as I have followed the instructions closely, and the galvanometer does not show any leakage?

Apparently your dynamo is all right, but you do not seem to have power enough to drive it. The excessive “pulling,” which stops the armature, shows that the voltage of the lamp is too low. Try a 12 or even a 15 volt lamp.

[636] **Estimating Output of Dynamo.** E. H. M. W. (Huddersfield) writes: I have a small dynamo, ring armature, about 12 in. high in all, and can drive it at about 2,500 revolutions by means of my 1-3 b.h.-p. gas-engine. I should be obliged if you could show me how to estimate the output. (2) Could I use such a dynamo as a motor?

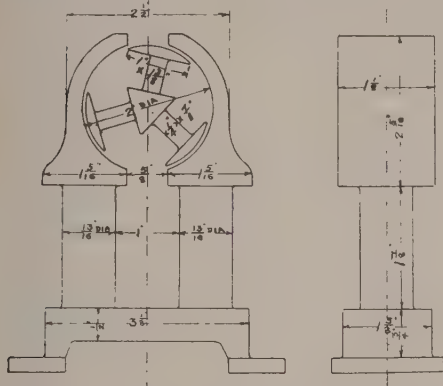
Your best plan will be to borrow a voltmeter capable of registering between 20 and 50 volts, and take the voltage of your dynamo at a fair rate of speed (2,500 revolutions per minute); then procure a few lamps of rather less than the indicated voltage (each taking about 1 ampere). Place them in parallel along the leads from dynamo, and see how many lamps the dynamo will bear without serious deterioration in the brightness of the light. You may then roughly estimate the output of dynamo to be x volts, as shown on voltmeter, multiplied into the number of lamps, reckoning these lamps as 1 ampere each. (2) You can use this as a motor, but in order not to reverse the polarity of machine, it will be advisable to ascertain the polarity of the two terminals, and always connect the + terminals of source to + terminal of dynamo (supposing this be shut wound).

[636a] **Small Manchester-Type Dynamo.** H. K. (Great Clacton) writes: (1) How many volts and amperes is it possible to get off the Manchester dynamo described in October number by winding larger wire and running at 3000 revolutions per minute? (2) Could I run a 16 c-p. lamp from it? (3) What power would it require to drive it?

If the dynamo in question were nicely wound with 3 lb. No. 22 D.C.C. on the armature, and with 8 lb. of similar wire on the field magnets, shunt connected, and driven at about 2000 revolutions per minute, it will give about 4 amperes at 50 volts pressure, or, say, sufficient current to light 4 lamps of 15 c-p., 50 volts. It will absorb about $\frac{1}{2}$ h.-p. to drive it.

[638] **Overtyping Dynamo.** H. H. D. (Leyton) writes: Enclosed are sketches of small overtyping dynamo. Please give size

and amount of wire for winding same, at what speed it could be run, and what will be the probable output? Will the dynamo charge two 4-volt pocket accumulators in series, and should it be connected up in shunt?



Your little tripolar dynamo will give excellent results if wound with 6 oz. No. 22 on the armature (2 oz. per section) and with 2 lb. No. 22 on the F.M. cores, connected up in shunt. The best speed will be about 3000 revs. per minute, the output about 15 volts, 2 amperes. The dynamo will charge 2 or even 3 4-volt pocket accumulators in series.

[651] **Faulty Dynamo.** H. T. W. (Tunbridge Wells) writes: I have made a dynamo, but it will not excite its magnet even if I short circuit the brushes with the magnet coils. It has a ring armature, 2 1/2 in. diam. and 3 in. long, made up of rings in the usual way and well insulated, all wound with coils of No. 22 wire, copper covered (should there be an even number of coils?); each coil has 50 turns and in two layers, and joined up in the proper way, namely—end of first coil to beginning of second and commutator, end of second to beginning of third and to bar 2 of commutator, and so on. The field magnets weigh 30 lb., and are wound with 6 layers of 56 turns of No. 22 wire on each limb. I believe there is not enough wire on them to excite properly, but surely it ought to give off a little current when working as a shunt machine? I have also tried it in series, but to no effect. I want the dynamo to give off 20 volts, and as much current as possible for charging accumulators. Can you suggest what is the matter, and, if I should wind again, what size wire on field magnet and armature?

It is almost impossible to say, without examination, what is amiss with the dynamo. The amount of wire on armature and fields, respectively, though not absolutely correct, are sufficiently near to enable the machine to work well, if all other things were right. But, notwithstanding your statement that the insulation is perfect, it is highly probable that you have a short circuit somewhere. This may be either from coil to coil in the armature, or from coils to iron or metallic particles between the segments of the commutator; or, again, defective insulation between the brush-holder pins and the brush rocker; or, lastly, between the F.M. coils and the F.M. cores. You do not say whether you have magnetised your dynamo. Perhaps your best plan would be to try whether it will work as a motor, if placed on a 50-volt circuit. This would not only magnetise it up, but would enable you to test whether there is any leakage, by connecting one pole of circuit to terminal of dynamo, and trying to spark with the other wire on to the bare iron of the carcass of your dynamo. If the machine runs the motor while shunt connected, it will, in all probability, generate as a dynamo if driven at about 2,500 revolutions per minute in the same direction. If it does not, it is probable that you have some false coils in the armature.

[653] **Motor for River Gig.** M. H. R. (Iron Bridge Rowing Club) writes: What would be the power of an electric motor capable of running a light river gig—displacement, loaded, say 5 cwt.—at six miles per hour, and number and probable weight of accumulators for a four-hours' run? Could you also say the best type of motor and accumulator? I saw mention some time ago of a new light amalgam accumulator plates, but cannot now hear anything of them.

To drive a light river gig, 5 cwt. displacement, at six miles an hour, would need an electric motor of the Manchester type, size about 1 ft. long, 1 1/2 in. deep over all, and 8 in. high, with 5 in. armature, weigh about 84 lb., if about 1 h.p. As to accumulators, you would need about 24 "Q" type cells like the E.P.S. motor costing about £1 per cell. Unfortunately, there is no known metal better than lead for the accumulator plates, and lead, as you know, is not the lightest of metals.

Amateurs' Supplies.

(The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.)

Engineering Made Easy.

There are two subjects encountered by the student of engineering which when presented on paper are very difficult to master. The action of the steam engine slide valve, and the proper relationship of lines and planes as discussed in the study of descriptive geometry. Mr. Thomas Jones of 4, Manley Road, Manchester, who is a popular and widely respected engineering teacher, has done much to smooth the path of students investigating these subjects by introducing some capital and remarkably cheap sets of working models, which show at a glance the principles involved. The set of slide valve models contains eight coloured cardboard working models showing the different types of slide-valves in common use, and the exact means by which they control the admission and exhaust of the steam in the engine cylinder. The models also show the relative positions of the crank-pin and eccentric at any portion of the stroke. A complete instruction book of about 30 pages is included which fully explains how the models are to be used. The set packed complete in a box may be had for 5s. 6d., or post free, 2s. 8d. Similarly with the geometrical set, there are twelve models showing the planes of projection, with lines and planes fixed in position. The models are schemed out on a very ingenious plan, and will at once make clear to the possessor the method of working out many problems which without these practical helps would be very puzzling to the beginner. The price of the twelve models, with full instructions, packed in a neat box is 2s., or post free, 2s. 6d. We can heartily recommend both these sets as a really valuable help to engineering students.

Motor Cars and Electric Ignition Apparatus.

Requiring some information on the subject of electric ignition for gas and oil engines, we recently paid a visit to the works of Mr. F. C. Blake, Dalling Road, Hammersmith, London, W. Mr. Blake, who has made a special study of this class of apparatus, showed us some well-finished accumulators, coils and ignition plugs of his own design, of which he has supplied a large number to motor cars and oil and gas engine makers. That he has faith in his own work was shown by the fact that the gas engine used to drive the lathe and other machine tools on the premises was fitted with one of these electric ignition sets. The coils give a good flaming spark with a one cell (2-volt) accumulator. They are fitted with platinum contacts for heavy and continuous work, and the secondary winding is protected from damp and mechanical injury by a light but strong covering, as will be seen from



the illustration. The illustration also shows a special portable accumulator of 2-volts and 35 ampere hour capacity, made up in a vulcanite case, with large rubber vent hole. Ignition plugs are supplied to suit every make of engine. Mr. Blake is also actively engaged in the manufacture of motor cars and motor cycles, and has a very complete and well arranged plant installed for this purpose. He showed us several vehicles in course of construction, and also some parts of small oil motors of his own design, which he is introducing for motor car work. We know that several of our readers are engaged in making their own motor cars, and it may be of interest to them to know that from this firm they can buy any finished parts which may be beyond the scope of their own workshop to produce. Another neat device which was also brought to our notice by Mr. Blake was a small switchboard, specially arranged for accumulator charging. Particulars of any of the above specialities can be had on application.

Catalogues Received.

Leppin & Masche, 17, Engel-Ufer, Berlin, S.O.—From this firm comes an English price list of Wilmhurst machines and sets of electrical apparatus, and also of cheap phonographs. Post free on application.

The Chloride Electrical Storage Syndicate, Ltd., Clifton Junction, Manchester.—A very handsome and well-illustrated catalogue reaches us from this firm, containing details of prices, etc., of various forms of lighting accumulators of their manufacture. It is claimed for the "Chloride" Storage Batteries that they have a very large capacity and high rate of discharge. Those who require accumulators for an installation on an extensive scale will find this list of much service. Other catalogues issued deal with the special type of accumulators, such as those for yachts or launches, traction, and portable batteries.

F. & H. Shaw, Limited, Helden Bridge.—The complete catalogue of tools, castings, etc., issued out by Messrs. F. & H. Shaw, has now reached us. Four new pages (Nos. 41 to 44) have been added, in addition to those we have previously noticed, and these contain descriptions and prices of an improved hand planer (finished, or in castings), a swivel-jaw machine vice, "Climax" instantaneous vice, and a slate punching machine. The whole catalogue is well-printed and illustrated, and will be sent to any reader mentioning *THE MODEL ENGINEER*, post free for 4d., which will be allowed on the first order.

T. M. F. Tamblin-Watts, Goldielands, Settle, Yorks.—We have received from this firm an illustrated catalogue (A) of physical apparatus and drawing and surveying instruments. Section I. deals with the latter, and contains prices of drawing instruments, theodolites, micrometer gauges, etc. Section II. deals with weights and balances, and Section III. with apparatus used in chemical, electrical, and all kinds of mechanical and physics experiments. It should be a useful list for students, for whom Mr. T. M. F. Tamblin-Watts especially caters, and to all connected with science classes. A very complete index adds to the value of the catalogue, which will be sent post free to any reader of this journal for 3d.

Stewart Electrical Syndicate, Limited, 5, New Compton Street, Charing Cross Road, W.C.—We have also received a leaflet from the Stewart Electrical Syndicate, illustrating a new incandescent lamp made by them, and which ought to prove by its neatness and great simplicity of much interest to our readers. We hope, therefore, to give in our next issue a more detailed description of the lamp, and other clever specialities sold by this firm.

P. Pitman, 13, Albert Terrace, King's Cross, Halifax.—Everyone has heard of Messrs. Pitman's "Demon" water motor, the latest improvement on which is noted in the notice of this firm before us. It is now claimed that less water is required to produce the same power, and that the governor is so sensitive that there is no appreciable difference in the speed when running light, or with the full brake load on. The high speed at which these motors run, and their steadiness and cleanliness, recommend them for such work as electric-lighting, driving fans, etc., wherever a pressure of water is available, and we note that the makers guarantee an efficiency of 80 per cent. A blue-print, showing a sectional drawing of the motor, explains the construction. Those interested should write Mr. Pitman for this catalogue.

Peto & Radford, Limited, 28, Victoria Street, S.W.—This is a neat price list of pocket and portable accumulators manufactured by Messrs. Peto & Radford. Attention is called to the fact that in the small pocket accumulators each separate cell contains a plate, viz., the positive plate between two negative plates, the advantage of which is well known to all users of these batteries. Many types are illustrated, such as those to suit cyclists, Röntgen ray workers, etc. Accumulators for motor cars and carriage lighting, running phonographs, small motors, and electric jewellery are also described, and those who need the above, or parts for making up sets of storage batteries, will find this list of much service.

The British Cycle Manufacturing Company, 45, Everton Road, Liverpool.—We have received from this firm a handsomely got-up catalogue of more than 50 pages, descriptive of the Royal Ajax and Silver Queen cycles. Every taste appears to be catered for, and we notice some useful hints to new riders. A large number of accessories are also shown, including lamps, saddles, pumps, mudguards, etc., and we note that this is a very complete list. It will be sent post free to any reader on mentioning *THE MODEL ENGINEER*.

The Stirling Electric Supply Co., Stirling, New Jersey, U.S.A.—Catalogue "A" by this firm, contains particulars of bells, burglar alarm apparatus, telephones, wires, insulators, batteries, etc. A good many items are squeezed into this little list.

A. Jones, 23, King Edward Street, Islington, N.—Readers thinking of making a gramophone, or speaking machine, should write to Mr. Jones for his list of parts for the construction of these machines; it will be sent to any reader of *THE MODEL ENGINEER*.

The Frasse Company, 19, Warren Street, nr. Broadway, New York.—A list of bargains is to hand from this firm, and those in search of cheap lines in twist drills, calipers, straight edges, hack saws, etc., should write for the special offer sheet, No. 834.

Reynolds Bros., 38, Pitt Street, Farnley.—This is a list of castings for engines, lathes, dynamos, water motors, fans, chucks, etc., which Messrs. Reynolds Bros. are selling at reduced prices

previous to stock-taking. Readers can obtain the list on mentioning this journal.

The International Trading Company, Cornwall Buildings, 35, Queen Victoria Street, London, E.C.—This firm, who have an extensive connection for heavy electrical goods, inform us that in future they intend catering more fully for the wants of amateur electricians than they have done in the past, and they send us some interesting catalogues of the many electrical specialities they are able to supply. These include some good and cheap lines in batteries, electric bells and bell sets, small electric-light sets, dynamos, motors, model electric tramways, water-motors and dynamos combined, induction coils, switches, pushes, lamps, etc. Lists of these goods will be sent free on receipt of stamp for postage. We have also received a sample of a new insulating material called "Presspahn." As this substance can be very easily cut or bent into various shapes, it should be useful for many purposes, such as making bobbins, &c. Sample and full particulars as to prices may be had on application.

Mr. E. Lindner, 170, Fleet Street, London, E.C.—Mr. Lindner has just issued a new catalogue of his patent "Air-cushion" rubber stamps. These stamps possess several features of advantage, especially in making impressions on rough or uneven surfaces. Readers who use rubber stamps at all will find this list well worth getting. It will be sent post free on application.

A. H. Avery, Tenterden, Kent.—The fifth edition of Mr. Avery's list of electrical apparatus is now before us. Special attention is drawn to the Lahmeyer dynamo and motor, on account of their high efficiency and scientific design. Armature windings, in many stock sizes and patterns are also listed, and we believe that Mr. Avery possesses facilities for promptly making any special size or shape to order. The other contents of the list include accumulators, resistance frames, measuring instruments, and castings and parts. Post free, 2d.

Thornhill Cycle Co., 24, Cloudeley Road, Islington, London, N.—This handsome catalogue, which has been established for some sixteen years, send us their 1899 list of "Royal Thornhill" and "Lady Stanley" high-grade cycles. These machines appear to be thoroughly up-to-date, and are supplied at either nett cash prices, or on the monthly instalment plan. Readers wanting a new mount for 90, should send a post-card for this list.

Whitney, 177, City Road, London, E.C.—Whitney's new electrical list is now ready, and will be sent to any reader on application. It does not by any means describe all the large stock of electrical goods which this firm supply, such being impossible within the limits of a gratis and post free list as this is. It, however, gives illustrations, particulars, and prices of a good range of specialities, such as bells, telephones, batteries and parts, small accumulators, Wilmhurst machine parts, chemicals, magneto machines, coils, lamps, dynamos, &c., and will be found very useful to the amateur.

Dale Bros., Dale Street, off Deansgate, Manchester.—Circular from Messrs. Dale Bros. reaches us with particulars of cycle parts and accessories, as supplied by them. Cycle makers and others wishing to build their own machines, should write to this firm for price lists, as they are prepared to supply any cycle part from a rivet to a racing machine. A separate list gives particulars and illustrations of forges and tools for cycle builders.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 3s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new prices and price lists, &c., for revision, should be addressed to THE EDITOR, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All correspondence relating to advertisements to be addressed to the ADVERTISEMENT MANAGER, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All subscriptions and correspondence relating to sales of the paper to be addressed to the publishers, Dawbarn & Ward, Limited, 6, Farringdon Avenue, London, E.C.

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 12, Cortlandt Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

THE

Model Engineer

AND

Amateur Electrician.

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How to Make a Desk Telephone.

By "ZODIAC."

THE desk telephone to be described in this article is a first-class instrument, thoroughly up-to-date, and should present no great difficulty to any reader in constructing. It will be found suitable for long or short

be inspected; a small, neat catch should be provided for fastening it.

The base is made of three pieces, and is hollow, in order to allow of the ringing key and the contacts being placed inside. All the case should be both glued and screwed together, brass screws being used; by this means a good firm job is made of it.

The transmitter is of the "Hunnings" type, and will

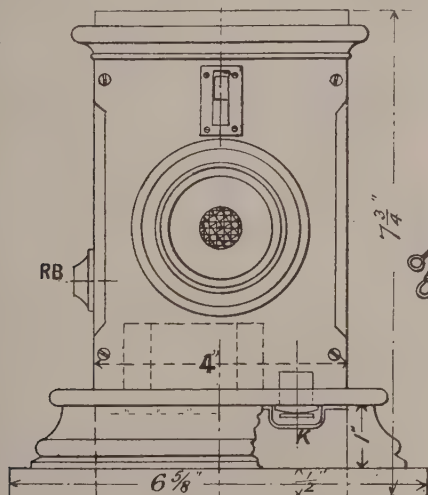


Fig. 1

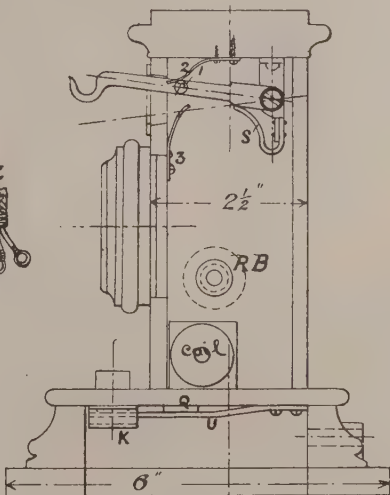


Fig. 2

lines, the writer having found a similar instrument to give splendid results on a three mile line.

The complete instrument (Figs. 1 and 2) consists of case, transmitter, receiver, switch, push or ringing key, and induction coil.

The case (see Figs. 1 and 2) should be made out of some hard wood, such as oak, walnut, or mahogany. The back being hinged to the side, allows the switch to

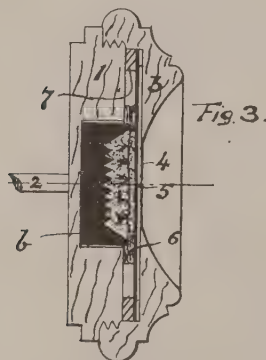
be found equal to any on the market. It is shown in section at Fig. 3. The back (1) and the front (3) may be turned up out of ebonite or hard wood as thought best.

If the amateur finds any difficulty in making the screwed part, he might leave it plain and fastened on the front (3, Fig 3) with brass screws. The recess in which the carbon block *b* rests is lined with stout tinfoil, which makes contact with the carbon block. The object of the

V-shaped face is to prevent the carbon granules, with which the space is filled, from clogging. The coarse silk network in the middle serves the same purpose; both, however, may be left out, the carbon face being left plain, with very little alteration in the results. A ring of cotton wool (6, Fig. 3) serves to keep the granules in their place, and also prevent overtones, due to excessive vibration of the thin carbon diaphragm (5, Fig. 3), which covers the whole. Contact with the diaphragm is made by means of the thin brass ring 7, a ring of soft blotting-paper on the other side serving to bed the front 3 to the same.

In order to protect the thin carbon diaphragm from injury, a piece of copper gauze, about 40 mesh (4), is placed over the opening. The whole is fastened to the case by means of two screws (2) at the back.

If the transmitter is so mounted that it can be turned round through 180 degs., then, by turning it from time to time, the settling down of the granules will be prevented, and the efficiency of the instrument will, therefore, not be affected. The connection can be made by means of flexible wire, so that the turning of the instrument will not affect it. One contact is taken off the tinfoil which connects the carbon block, the other connection being made to the carbon diaphragm by means of the metal ring 7 (Fig. 3).



The thin carbon diaphragm and the carbon granules can be had from any dealer in electrical goods. Of course, if the reader wishes, he might use a simple two-pencil carbon microphone with a thin pine-wood diaphragm. If only used on short lines, such a simple microphone will answer very nicely. Some information on pencil microphones was given in No. 2 of THE MODEL ENGINEER. They are, of course, not nearly so powerful as the "Hunning" form, which now hold the field for telephone work, being used by the General Post Office to the exclusion of all others.

The receiver is of the watch pattern, and is shown in Fig. 4, where B is the hard wooden back with case R and front S, L being a liner to screw on the front piece, clamping the diaphragm d. The circular-shaped magnet M will have to be cut out of the very best sheet steel and hardened by heating to dull red and cooling in water. The pole-pieces PP are of soft iron, screwed into the steel piece M. The coils cc should be wound with silk-covered wire, No. 38 or 40 gauge, taking care to wind the two coils like an eye. The terminals are placed on the block of vulcanised fibre F, the flexible wire going

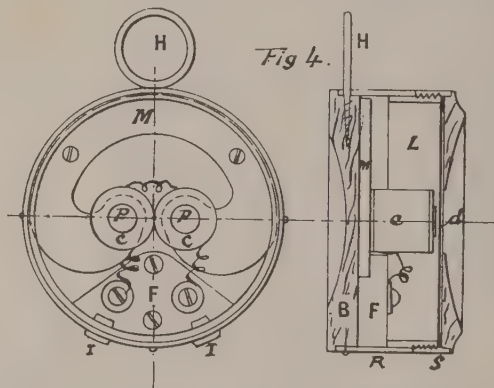
through the ebonite bushes II. An ordinary picture ring (H) serves to hang it on the switch hook. If required, the watch receiver can be bought. Very neat "Manchester" watch receivers in ebonite or metal cases, cost 7s. 6d., including the cord.

The induction coil consists of two square ends having $\frac{1}{4}$ in. holes drilled through their centres. Now cut off a number of $2\frac{1}{2}$ in. lengths of No. 22 soft iron wire, and put these through the holes so as to make a bobbin with the iron wires as a core. The wires should fit tight into the hole, and having seen that the two ends are square with one another, so that they bed truly, give the iron core and bobbins a good coat of shellac varnish, letting plenty go into the wire bundle. This will fasten the whole together. Now wind carefully over the iron a layer of silk tape, and shellac it well.

Over this should be wound the primary winding of No. 24 s.c. wire, the ends being taken out through holes in the bobbins. Over this primary winding should be wound a layer of silk tape, well coated with shellac, to insulate it from the secondary.

The secondary winding should be carefully wound on, No. 36 silk-covered wire being used.

The amount of wire to put on the respective winding is somewhat dependent on the construction of the line. For all-round work a primary resistance of 5 ohms, and a



secondary resistance of 250 ohms will be hard to beat. If the amateur winds two layers of primary wire on the bobbin, and then fills it with the secondary winding, it will be about right. The coil is screwed to the case as shown in Figs. 1 and 2.

The switch-hook is clearly shown in Fig. 2. It is free to work up and down from the end bracket to which it is screwed. At the top are two springs, 1 and 2, which make contact with the circular pin, P¹ (which projects on either side of the switch arm), when the arm is forced up by means of the spring, S¹. In the lower position the arm makes contact with spring 3. The springs may be of brass or German silver.

The ringing key is fixed at the base of the instrument. Normally, the brass spring (u Fig. 2) presses on the top contact Q, but if the push is pressed it will make contact with K.

The different connections are shown in Fig. 5.

When the receiver is on the switch-hook, the latter contacts contact with spring 3. Any current coming along the line will go through ringing key, contact Q, to bell,

and then by switch-hook and spring 3 to earth, and so back to the other instrument.

If the ringing key is pressed, the current will flow from carbon of battery to contact K, arm *u*, on to line, and so ring the bell of the other instrument.

If, now, we take off the receiver, the spring will force up the switch-hook and make contact with springs 1 and 2. The primary circuit will now be M.C. to microphone, primary winding of coil, spring 1, switch-hook, and back to battery. The secondary circuit will be L, receiver, secondary winding of coil, spring 2, switch-hook, earth, and so to the other instrument. Hence, words spoken into the transmitter will cause undulations in the primary circuit of the coil, and so induce undulatory currents in the secondary circuit, which will go to the other instru-

The bell may be of the 3 in. circular pattern, with movement under the gong, and can be fitted at the back of the instrument, or an ordinary electric bell may be used and fixed apart from the instrument in any convenient position. In this latter case the flexible cable will have six wires instead of four, as two extra wires will be required for the bell. In the case of a desk, the bell and dry cells can be nicely placed out of sight in the knee-space.

The external finish will depend upon the taste of the reader. The case may be polished, varnished, or left plain. All the brasswork, except the contact parts, should be nicely finished and lacquered.

To receive a call, the bell having rung, press the push and then take the receiver off the hook and hold it to the

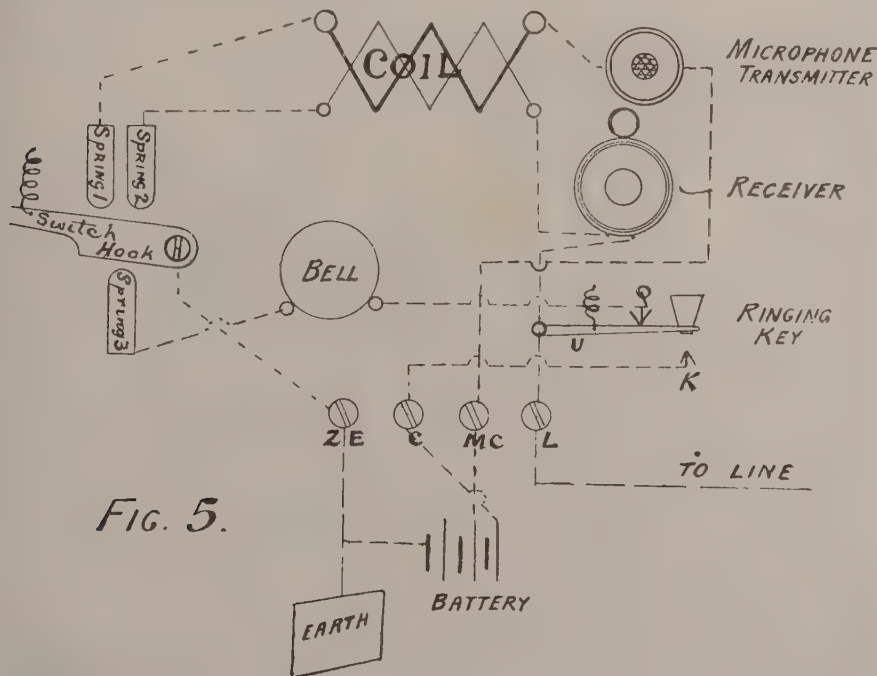


FIG. 5.

ment, and so reproduce the sound in its receiver and vice versa.

The receiver cord will pass through the ebonite bush RB (Figs. 1 and 2); the flexible wire, which connects the line and battery to the instrument, going through the back of the base.

The connecting terminals are arranged under the top piece of the base, so that by turning the instrument upside down they are easily got at through the opening in the bottom. In connecting up (see Fig. 5) the flexible conductor, its ends should be carefully prepared with loops, as shown in drawing Z, and these put under the screws. This will prevent stray strands from short-circuiting two or three terminals. The other end must be taken to a rosette placed in some convenient position. To this rosette are taken the battery and line wires the battery being placed out of sight. Dry cells should be used.

ear. Speak on to the opening of the transmitter. After use, always replace the receiver on the hook or the batteries will run down.

To call up the distant station, press push, wait till bell rings in reply, and then take off the transmitter from the switch-hook.

By slightly altering the design and parts, the instrument might be used for a wall telephone. If, however, any readers require to have a wall telephone, I will, with the editor's permission, give a new design for the same.

In order to make the extent of fine cracks in tools, etc., visible, it is recommended to moisten the surface of the cracked article with petroleum, to rub off clean and to wipe off the surface with chalk. The petroleum which has entered the fine crack sweats out and the rent is visible in its whole extent.

Model Engineers and Their Work.—II.

Messrs. T. and C. J. Coates.

(Concluded from page 48.)

THE original "Corliss" valve gear was invented by Mr. G. H. Corliss in 1849. Not being an engineer, he experienced exceptional difficulty in getting his invention tried, but the results obtained ultimately led to its very extensive adoption. The first Corliss engine in Europe was that shown at the Paris Exhibition in

two steam valves. As the arm reciprocates, the steam valves are alternately opened, but, at certain points, determined by the speed of the governor, the lever of the steam valve then opening slips off the corresponding driving plate; the valve then left free is rapidly turned into a closed position by the action of a helical spring. The spring is contained in a small cylinder provided with two air "dash pots" by which the quick closing motion is quietly arrested. This sharp and automatically adjusted cut-off is now to be found in all modern "trip" gears.

The governor shown is of the high speed loaded type, and has its sensitiveness adjustable by means of a spring, which is contained within the central weight. It is driven

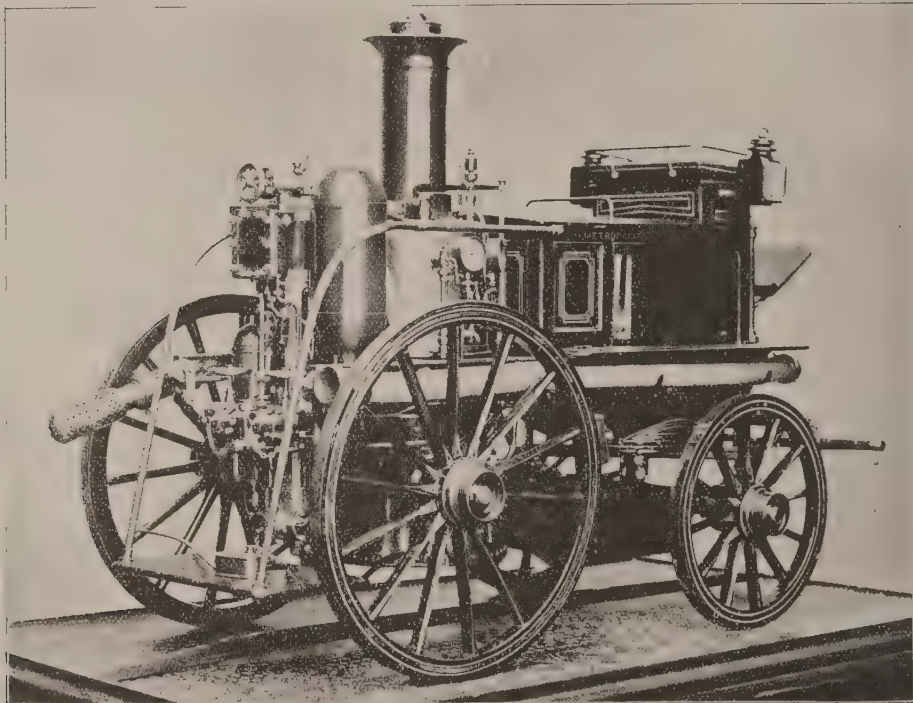


FIG. 10.—MODEL OF VERTICAL PATTERN STEAM FIRE ENGINE.

1867. The leading features of the arrangement are: the employment of separate steam and exhaust valves at each end of the cylinder, so that any alteration of the point at which steam is cut off can be made without interfering with the action of the exhaust valves; the valves are cylindrical, and each is capable of being separately adjusted. The two exhaust valves, which are at the bottom of the cylinder, are rocked by a single eccentric, while the two steam valves at the top are rocked by another eccentric. The steam eccentric swings an arm provided with a cylindrical end upon which are two hardened steel plates; as the arm swings, these plates engage with similar plates attached to flat levers that proceed from cranks on the spindles of the

by three cotton ropes; but, to further reduce the risk of the engine running away through the governor stopping, an independent gear is fitted, so that if, after the engine has been started, the speed of the governor falls below a certain limit, a trigger releases a weighted lever, which automatically stops the engine through its valve gear.

In Fig. 10 we show another model of a steam fire engine, which has been very generally admired. It is a scale reproduction of one of Messrs. Shand, Mason and Co.'s vertical pattern Metropolitan Fire Brigade engines, the scale being $2\frac{1}{2}$ in. = 1 foot. The machine is carried by large wheels on mail-coach axles, with a forelocking carriage, and is generally arranged for rapid travelling, two horses being employed. The delivery hose

is stored in a central box, which also contains a tank for the boiler feed water. The two lengths of heavy suction hose are carried one on each side beneath the fireman's footboard, and a coal bunker under the fore carriage holds a supply of fuel conveniently near the turnace floor. The box seat is utilised as a tool store, and two short branch pipes with nozzles are carried, one on each side of the box, and two long ones over the hose box. The pole terminates in a special form of crap, by which a horse that has fallen can be quickly released, and the hind wheels have a powerful lever brake.

The pumping machinery consists of a vertical steam cylinder 7.5 ins. diameter, 7-ins. stroke, and a double-acting bucket and plunger pump with an 8 in. bucket and a 6 in. plunger. The piston is directly connected to the plunger by two piston rods, which permit the horizontal crankshaft to be placed in the centre line of the engine, a return connecting rod from the interior of the plunger connecting the reciprocating parts with the crank pin. A full stroke is thus secured, and a flywheel introduced which carries the engine over its dead centres. An overhanging eccentric works a short D slide, and also a feed pump attached below in line with the valve rod. The suction box of the pump is directly below the barrel, and the delivery takes place above, two sluice valves being arranged to direct the water into two lengths of delivery hose. A spring loaded relief valve permits the return of water from the delivery box into the suction valve-box if the pressure rises above that safe for the hose. A large copper air-vessel is placed on both the suction and delivery boxes, to prevent any concussion in the pipes, and a pressure gauge in front of the boiler registers the pressure in the hose.

Steam at 100 lb. pressure per square inch is supplied by a vertical boiler, internally fired, and having the fire-box crossed by numerous rows of inclined water tubes, the total heating surface obtained being 56 square feet. The boiler shell is in two lengths, bolted together, to render the firebox accessible for cleaning and repairs. The shell and firebox expand towards the base, so increasing the grate area up to 4.5 square feet, and owing to the exhaust from the cylinder being sent through a blast pipe in the funnel, a very sharp draught is obtained. The boiler is provided with two spring-loaded lever safety valves, an injector, steam whistle, and a jet into the funnel for drawing up a poor fire, besides the usual other fittings.

The engine indicates 30 h.-p., delivers 350 gallons per minute, and weighs rather under $1\frac{1}{2}$ tons. With a $1\frac{1}{8}$ in. nozzle the jet reaches a height of 160 ft. Steam is raised to the full pressure of 100 lb. per square inch in six minutes from the time of lighting the fire.

This model is in all respects a complete working machine, even to the pressure gauges and injector. The boiler is of copper, with 70 cross tubes, and was tested to 300 lb. per square inch. It burns coal, and has raised steam from cold water in seven minutes. The engine throws a continuous jet 3-16ths in. diameter to a height of 65 feet, when running 360 revolutions per minute.

Mr. Thomas Coates has also contributed a very fine model manual fire engine to the South Kensington Museum.

The last of our illustrations (Fig. 11) shows Messrs. Coates' latest production, which has only been placed in the South Kensington Museum within the last three months. This is a model of a high-speed compound electric light engine, to a scale of 1-6th of full size, with Hackworth & Marshall valve gears, a gear of each type being fitted, one to the high-pressure cylinder and the other to the low-pressure cylinder. The diameter of the h.-p. cylinder in the model is 2 3-16ths ins., and the l.-p.

cylinder 3 15-16ths ins., by $2\frac{1}{4}$ ins. stroke. The engine has a flywheel for rope-driving to take 10 ropes, the diameter of the wheel on the pitch line of rope being 15 ins. This model took nine months to make, working twelve hours a day.

Messrs. Coates are now engaged in making a tender for the model L. & S.W. Ry. locomotive already described, which they propose to present to the museum authorities when complete. They have, however, another model in progress, which they take in hand at the few odd moments when they have nothing else to claim their attention. This is a model of the 5000 h.-p. triple expansion marine engines belonging to the Pacific Steam Navigation Company's mail screw steamer "Oceanic"; the scale adopted being $\frac{3}{8}$ in. = 1 ft. The diameters of the cylinders are h.-p. 1 13-16ths in.; intermediate, 3 1-16ths in.; l.-p., 5 ins.; while the stroke is $3\frac{1}{2}$ ins.

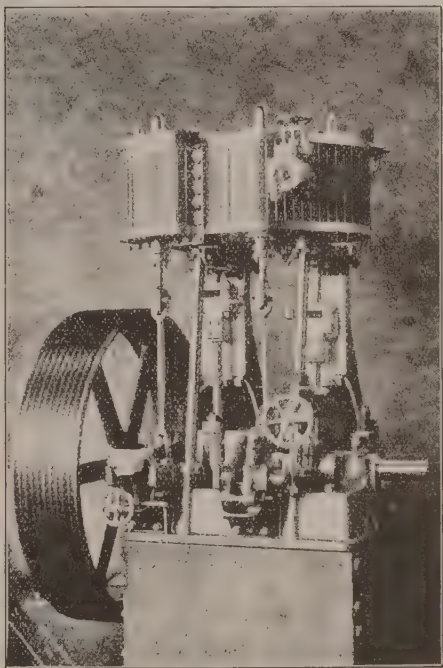


FIG. 11.—MODEL OF HIGH-SPEED ELECTRIC LIGHT ENGINE.

So far, about seven months' work has been put into this, but for the past five years they have found no spare time at all to make further progress. Mr. Coates estimates that if they could give their whole time and attention to this particular piece of work, it would take them over three years to complete it. When finished, however, it will be one of the most perfect and complete models ever made, as it will comprise a complete engine room, including the bottom of the ship, with all auxiliary machinery, such as a 2 cylinder reversing engine, 2-cylinder turning engines, two sets of compound centrifugal engines, overhead traveller, skylight, &c. Mr. Coates added that this model is intended for their own private museum some day, and will be their masterpiece.

The following particulars of some of the models made by Mr. Thomas Coates alone, many years ago, mostly when in Russia and Germany, will also be of interest:—Hanoverian express locomotive and tender, $\frac{3}{4}$ in. = 1 ft. (Frampton type). Model of the first steam fire-engine sent out to Russia by Shand, Mason & Co. in 1862, 2 ins. = 1 ft. Two cylinder screw engines of Russian iron-clad, horizontal, with jet condenser and return connecting rod. Horizontal steam engine model and boiler in the Imperial State Paper Works, St. Petersburg. Two oscillating paddle engines, with condenser and air pump, of Imperial yacht "Vesta"; and also a great many experimental models.

In concluding this description of the work of these wonderfully clever model makers, it may not be out of place to make brief mention of some of the awards they have received for their skill when their models have been shown at public exhibitions. In 1880, as previously mentioned, they secured a gold medal at the Alexandra Palace; in 1888 a silver medal at the People's Palace for a model of a Shand & Mason steam fire-engine; in 1888, at the Society of Arts Co-operative Home Industries Exhibition, they gained a bronze medal for another steam fire-engine; in 1890, at the Crystal Palace, they again scored with a model Shand & Mason steam fire-engine; and in 1891, at the "Work" Exhibition at the Polytechnic, they secured three medals and a book and money prize for a double horizontal Merryweather steam fire-engine. The reader will have gathered from our previous remarks that these successes have not been earned without many years of varied experience, study, and most patient and careful application of the remarkable mechanical skill which the Messrs. Coates possess. The models in the South Kensington Museum made by these gentlemen are standards of perfection in workmanship which our readers may keep before them as an ideal to be attained as closely as within their power.

We have to express our grateful appreciation of the extreme courtesy and kindness with which Messrs. Coates have furnished us with the photographs and necessary details for these articles, and in making this acknowledgment we feel that we are also voicing the feelings of thousands of our readers who have, as we know, perused these particular pages with unusual interest.

A Model Electric Tramcar Motor.

By A. H. AVERY, A.INST.E.E.

(Continued from page 43.)

THE fibre disc— $1\frac{1}{8}$ in. diam., $\frac{1}{4}$ in. thick—is gripped in a self-centring chuck, the face turned and centre marked. If the fitter possesses a division plate on his lathe, the six holes for screws to hold the brass segments may be set out before removing from the chuck, otherwise the compasses can be used to mark six equidistant points on a circle 1 1-16th in. diameter. Drill these with $\frac{1}{16}$ -in. holes, countersinking the back to let the screw heads go in flush or even a little beyond. The brass ring which forms the commutator segments is $1\frac{3}{8}$ ins. outside diameter, $\frac{3}{4}$ in. inside diameter, and $\frac{1}{8}$ in. thick. This ring is drilled and tapped at points corresponding to the holes already drilled in the fibre disc, and the two screwed together with $\frac{1}{16}$ -in. brass screws with countersunk heads, after removing all burrs with a file. Next divide the brass into six equal segments, with the fastening-down screw well in the middle of each, and make fine saw cuts just through the brass down to the fibre. These cuts are next filled in with thin sheet fibre hammered in tightly;

a drop of shellac varnish first run in the slit will help hold. At this stage the commutator is mounted in the chuck again, with the brass ring running as near true as possible, and edges, face, and inside turned up and polished. At the same time bore out the centre truly and tap with a $\frac{3}{8}$ -in. taper tap with a thread matching the screwed portion of the armature shaft, and only running the tap in so far as to allow the fibre to screw tightly on the shaft. This part of the work requires care, and the tapping should be done in the lathe with the back centre up, to ensure the tap going through square; a trace of oil should be used. Lastly, remove from the chuck, and drill and tap six radial holes on the edge where brass and fibre meet to take 1-16th-in. brass screws for connecting the armature wires; these holes should be mostly on the fibre side, but at the same time just touch the inner face of the brass to ensure good contact with the segments. Their position will be rather on one side of the holding-down screws, to avoid cutting into and breaking them; and when tapping pinch the back and front of the commutator

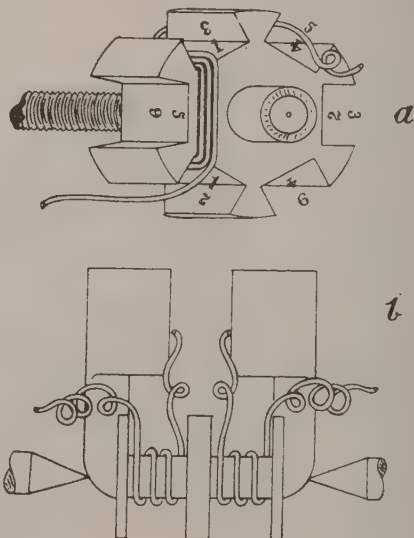


FIG. 3.

between the jaws of a vice to avoid forcing them apart. The finishing touches are made with the commutator screwed into position on the shaft in order that it may ultimately run dead true. It should be here stated that the drawings in Fig. 2, February issue, were shown full size.

The construction of the brush-holders is shown in the sectional sketch *c* (Fig. 2), and they are turned from $\frac{1}{4}$ -in. brass rod. The brushes (*d*) may consist of fine copper wire gauze rolled up tightly into a cylinder which will slide freely in the holder; and the necessary means of keeping them in contact with the commutator and taking up wear, is provided by the brass spring *e* made from No. 26 hard-drawn brass wire. The brush-holders pass through 5-16ths-in. holes in the web of the brass bearing, at a distance of 1 1-16th in. apart (which brings the brushes centrally on the commutator segments), and are insulated therefrom by thin sheet fibre washers, with a lining of thin fibre round the inside of the hole.

The terminal board, of hard red fibre, $1\frac{1}{2}$ ins. by $1\frac{1}{2}$ ins. by $\frac{1}{2}$ in. thick, is shaped as *f* (Fig. 2), where the lower figure shows the underside, and the upper one the back end, the dotted lines indicating 1-16th in. holes drilled through the centre for connecting. The larger holes are for the terminals, and the others to admit 1-16th-in. screws for fastening down on top of the pole-pieces.

A couple of 3-16th-in. holes drilled through the limbs of the carcass as shown in A (Fig. 1) for holding the whole machine down, will now complete the motor as far as fitting is concerned.

All the parts which receive wire are now carefully insulated, the best material to use for the purpose being thin fibre sheet, 1-64th-in. thick. To make this lie well in sharp angles such as the bottom of the teeth on the armature, cut it half through from the back, and it will then bend sharply. All sharp angles on the iron must be previously well rounded off with a file.

Having dressed the armature, mount it between centres (or hold it by hand if more convenient) and start the winding as shown in *a* (Fig. 3), putting on three layers of No. 24 wire, each layer consisting of twelve turns. Now refer to the winding diagram (*a*) where the slots are so figured as to show where each succeeding section must be wound by turning the armature until the number of that section is in an upright position. Each section is wound in precisely the same manner and direction, so that when completed, the slots will have six layers of wire in each. In connecting up join the starting end of each section to the finishing end of the next adjacent to it all the way round, and carry each junction so made down to one commutator segment; the slits in the commutator should correspond with the teeth of the armature core, and enough length of wire allowed in the armature connection for slight adjustment of the position of the commutator. To distinguish easily between starting and finishing ends it is as well, when commencing to wind each section, to make a "kink" in the starting end; this will avoid any doubt in connecting up. When the winding is done, the armature should be well served with shellac varnish, and put in a warm place to dry.

The field magnet coils consist of thirteen turns of No. 20 wire, in nine layers, wound on each side of the centre flange of the yoke, and this part of the work presents no special difficulty. Fig. 3 *b* shows method of starting the winding. Having mounted the carcass between lathe centres after insulating the wire spaces, one half is wound, and when full the motor is turned round, and the winding duplicated in the empty section similar in every respect.

After varnishing, the two starting ends are carried up through the terminal board to the brush-holders, and these secured by the setscrews at the end; while the finishing ends are taken each to one terminal (G, Fig. 2) by way of the inside pair of holes in the edge of the terminal board. The latter are secured to the terminals by being passed under the heads of their holding-down screws.

A judicious application of enamel will now put the finishing touches, and the machine is ready for work.

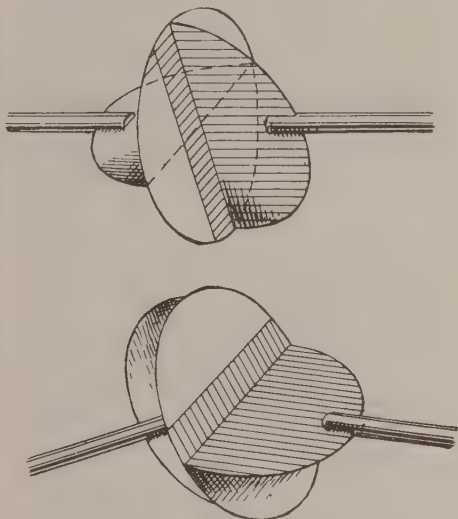
The question as to how power is to be conveyed from the armature shaft to the driving axle of the tramcar is best left to the discretion and ingenuity of the maker, who is fully acquainted with all the circumstances of the case. The author has found worm-gearing to give best results on the whole, using a worm of $\frac{1}{8}$ in. pitch, $\frac{1}{2}$ in. diameter, $\frac{3}{4}$ in. long, and a skew-cut worm wheel 3-16ths in. thick, 1 in. diameter, having about twenty-five teeth. This gives a reduction in speed of 25 to 1, and a corresponding increase in power, enabling the motor to do its work much more efficiently than would be the case if the normal speed of the armature were reduced to that extent.

A Simple Model of Hooke's Joint.

By W. J. TENNANT.

TO make the model here illustrated, cut out of stiff paper three equal and similar discs. Upon the faces of one of these draw diametrical lines passing at right angles to each other across the centre.

Fold two of the unmarked discs across their centres, and paste one half of each folded disc (from which a portion can be cut away, as shown) to one face of the remaining disc, which must not be folded. Take care that the hinges, which are constituted by the fold of each, come upon the diametrical lines previously referred to, it being understood that one folded disc is secured to one side of



the main disc, and that the other is secured to the opposite side, the two hinges being situated at right angles to each other. Two pieces of pen-holder, each slit at its end and pushed on to one of the projecting half-discs, as shown, serve as shafts.

The result is a simple model of an universal joint, which, when rotated, sweeps out a sphere, and will serve to illustrate the mode of action of the ordinary Hooke joint and also of the moving parts of the Tower "spherical" engine.

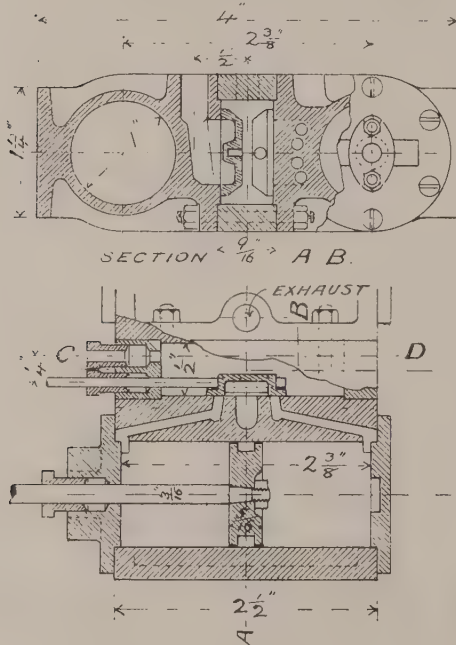
The Seventh Annual Yachting Exhibition at the Royal Aquarium, London, was opened from February 1st to March 2nd, and contained several items of interest to model engineers, in addition to a very fine show of rowing and sailing boats, steam and other launches, and yachting accessories. Among the models on view we noticed a fine one of the s.s. "Yarmouth Belle," and at the stand of Messrs. Des Vignes & Co. a splendidly finished scale model of one of their well-known launch engines. Mr. C. H. Harris exhibited a model of a 96 ft. electric yacht to a scale of $\frac{1}{4}$ in. to the foot, fitted complete with motor and cells in working order.

Design for Model Locomotive Cylinders.

By E. L. PEARCE.

THE accompanying drawings show a pair of inside cylinders, 1 in. bore and 2 in. stroke, suitable for a model locomotive, to a scale of 1 in. to the foot, the gauge being $4\frac{3}{4}$ ins. between the rails. The driving wheels may be about 6 ins. diameter for a single pair, and about $5\frac{1}{2}$ ins. for a four-coupled engine; small carrying wheels $3\frac{1}{2}$ ins. diameter.

The diameter of cylinder is, of course, small for a 1 in.



scale engine, but for several reasons it is advisable to employ cylinders of smaller diameter in proportion to the wheels and boiler, so that the latter will be able to supply the quantity of steam required, and the valves, ports, etc., have more room, and can be more easily fitted.

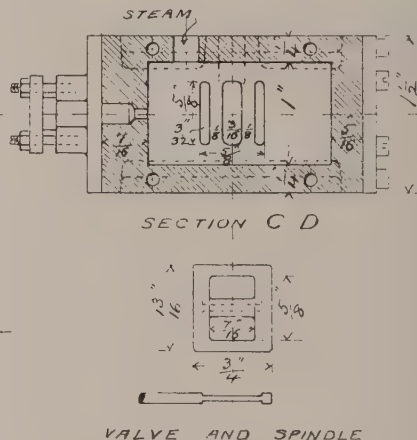
One pattern will do for the two cylinders. It is made like the drawing, but is left solid inside, with a projection or point at each end $\frac{1}{2}$ in. long, and $\frac{1}{8}$ in. diameter. The pattern should be made slightly longer and wider than the dimensions given, to allow for shrinkage and filing up true. The exhaust and steam ports are drilled out of the solid. The patterns for cylinder covers, piston, valve, and valve chest are made like the drawing, with an allowance for filing or turning up.

It will be noticed that on the back cylinder cover two lugs are shown, one on either side of the piston rod stuffing-box; these are to take the ends of the four slide bars, but by turning the cylinder cover a quarter round, two slide bars can be used, one above and one below piston-rod, or one single slide bar may be employed, with a cross-head

similar to those used on the Great Eastern Railway engines.

The boiler for this engine may be from 4 ins. to $4\frac{1}{2}$ ins. diameter, and 10 ins. long in the barrel, the outside firebox being 6 ins. long and $3\frac{3}{8}$ ins. wide, smokebox $2\frac{1}{2}$ ins. long. The inside firebox being 5 ins. long by 3 ins. wide, 5 ins. deep at front end, and $4\frac{1}{2}$ ins. at back; there may be six brass tubes $\frac{5}{8}$ in. inside diameter, 1-32nd in. thick, and about $10\frac{1}{2}$ ins. long. The metal for boiler may be brass or copper, 1-16th in. thick for a pressure of 50 lb. to 60 lb., or 3-64ths in. thick for 30 lb. to 40 lb.; tube plates 3-32nds in. thick; inside firebox of copper.

The cylinders could be made $1\frac{1}{8}$ in. bore by making



PAIR OF INSIDE CYLINDERS FOR
MODEL LOCOMOTIVE TO INCH SCALE

pattern $\frac{1}{8}$ in. larger in diameter without altering valve-chest, &c. These would drive single wheels $6\frac{1}{2}$ ins. diameter, and the engine might be a model, as far as external appearances go, of the late Mr. Stroudley's excellent 6 ft. 6 in. single express engines.

Don't use your lead, copper, or iron vice clamps after filings have become imbedded in them to any considerable extent. It is then time to get new ones, because the presence of the filings renders the clamps useless for the purpose for which they are intended—namely, to provide a softer surface than the work they grip. If steel filings are sunk into the clamps, they will, of course, damage brasswork without much pressure being exerted, because the filings sticking out act like little teeth. Another point with regard to clamps is the indiscriminate manner in which they are sometimes used. A piece of bright work will be held in the vice, and the clamps will, of course, be necessary. Then, perhaps, a rough casting will be gripped, without troubling to remove the clamps. The sand and grit adhere to them, and by the pressure become squeezed in, very quickly rendering them useless for holding brass and polished work.—*Mechanical World*.

How to Make a Five-Inch Screw-Cutting Lathe.

By WALLER MARTIN.

(Continued from page 14.)

THE loose head will now be taken. A piece of round mild steel $1\frac{1}{4}$ ins. diameter, 6 ins. long, will be required to make the barrel; centre this accurately and drill a $\frac{3}{8}$ in. hole through, then enlarge this to $\frac{1}{2}$ in. to within $\frac{3}{4}$ in. of the other end. The barrel O will now be turned and fitted to bored hole in loose head, and no pains should be spared to make this a very exact fit. When fitted, a screw will be either cut or tapped with a square-thread tap $\frac{1}{2}$ in. diameter, 8 threads per in., left-hand is the most suitable size for our purpose.

The traversing screw N may now be cut out of mild steel, turned and screw-cut to sizes given. The cap V of cast-iron is turned, fitted, and screw holes drilled, corresponding holes being drilled and tapped on loose head. The best way to do this so that the holes coincide, is to place the cap in position, and revolve a drill by hand a few times in each of the three holes in cap, using the same drill used in drilling the cap; this will accurately mark the centres. Oil-holes should be drilled in cap, also in head-stock through bosses, and speed cone F. A lug is cast behind the loose head on barrel; this should have $\frac{1}{4}$ in. hole drilled at about $1\frac{1}{2}$ ins. from end of casting, and then a saw-cut is taken down to meet this hole, the object being to split the casting for about $1\frac{1}{4}$ ins. up. This, when pinching screw (2) is fitted springs the bore hole just sufficiently out of truth to lock the barrel from moving whilst turning.

The pinching screw (2) of mild steel is turned and tapered, and may have a handle, or simply a Tommy hole drilled through. A $\frac{3}{8}$ in. clearing hole, will be drilled through top half of lug, and a $\frac{3}{8}$ in. tapping hole through bottom half of lug. The mouth of the steel barrel will be either reamed or turned taper. The centre is turned out of best tool steel, and fitted accurately to the taper in barrel, a keyway is milled, planed, or filed $\frac{1}{8}$ in. wide, $\frac{1}{2}$ in. deep, a steel pin being screwed in casting to engage in the keyway, which is to keep the barrel from turning round whilst sliding. Two flats are filed on centre, after which it can be hardened and tempered, and it must be noticed that if the shank end is left long enough the centre can be made self-discharging by running the barrel back when centre wants removing. It should just touch the traversing screw when barrel is almost in, and it thus will be self-discharging without having recourse to a spanner to remove it from barrel.

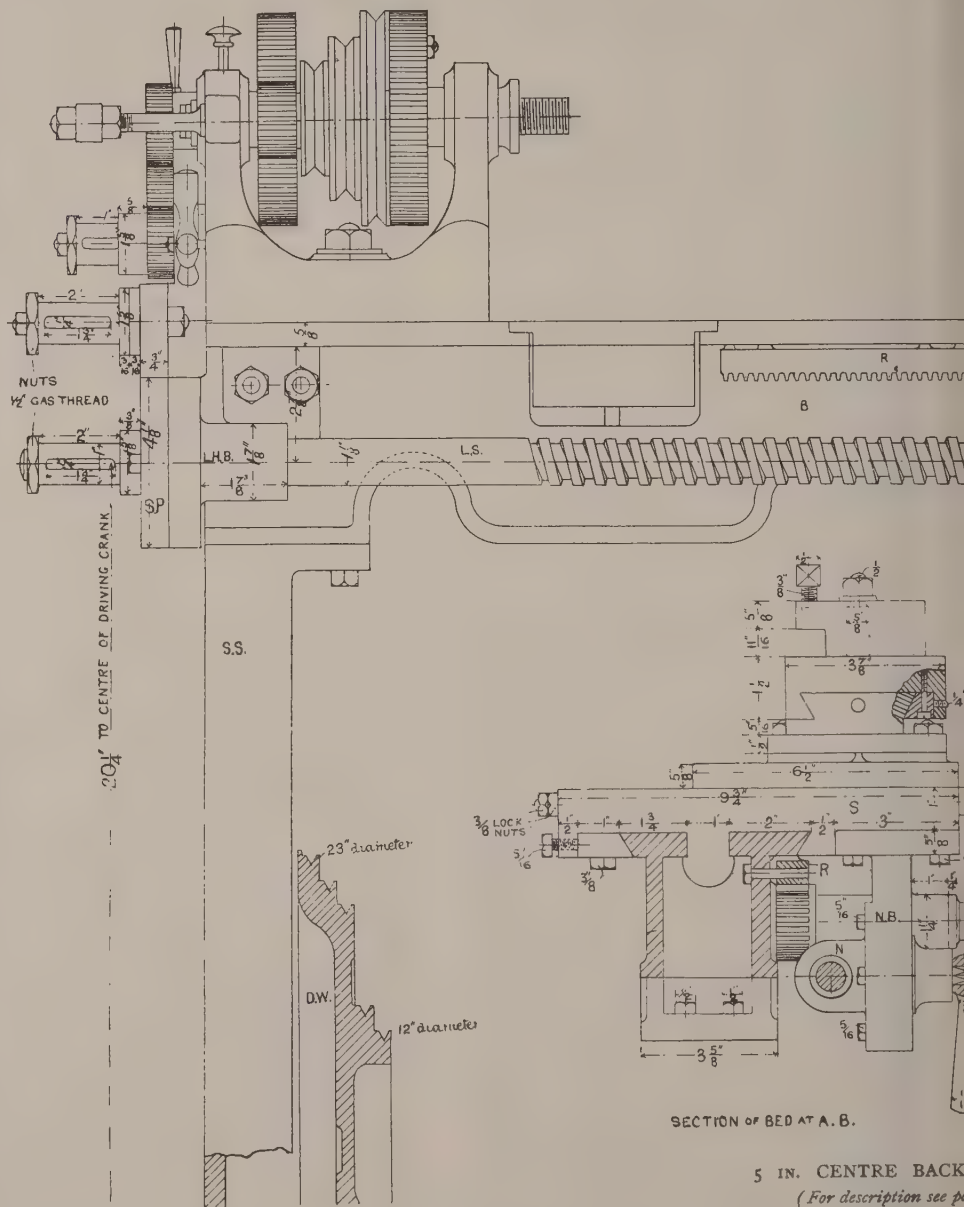
The hand wheel M is of cast iron, and it will be bored, turned, polished, and fitted to traversing screw, a steel pin $\frac{1}{2}$ in. diameter should be put in shank of the latter, and a suitable keyway cut in handwheel so as to prevent the hand-wheel from moving independently of screw.

Some amateurs having more space at their disposal than others, as a matter of convenience, it is proposed to supply the bed in two lengths, 3 ft. 6 ins. and 4 ft. 6 ins. The drawings to scale show a 3 ft. 6 ins. bed. Reference to parts shown in drawings:—B., bed; L.H.B., left-hand bracket; R.H.B., right-hand bracket; L.S., leading screw; N., nut; N.B., nut-box; S.P., swing-plate; R., rack; S., saddle; S.S., standards; C.S., crankshaft; D.W., driving wheel; R.W., roller-wheels; T.L., treadle levers; B.S., treadle back shaft; T.R., tie-rod stay. The bed of lathe we will now proceed with, presuming it to be planed on top and edge surfaces, and on under side where standards are fitted, and also facing pieces where brackets are bolted. The top surface of bed

will be scraped, filed, and surfaced up; also the V edges, which, as all other sliding surfaces, are planed at an angle of 60 degs. The saddle also being planed, filed, and surfaced up, the loose strip will be drilled with four $\frac{3}{8}$ -in. clearing holes, and the saddle with $\frac{3}{8}$ -in. tapping holes; three 5-16ths tapping holes will be drilled in back of saddle to set up the strip and adjust for wear, $\frac{3}{8}$ -in. set bolt being used to bolt strip to saddle. Work saddle by hand up and down entire length of bed; put plenty of oil on bed and a little colouring material (red lead). If (as probably will be the case) the saddle does not slide up and down uniformly, the high or tight places on bed must be carefully filed a little, and saddle again tried; this being done, the saddle should be worked up and down bed; a little knife polish (Oakey's, sold in penny packets) sprinkled on bed with plenty of oil, will grind the saddle in, and when saddle fits bed without slackness throughout its entire length, carefully wipe all parts free from the oil-grinding powder. The slides of the compound rest will be dealt with in a similar manner, and no pains must be spared to get a quite perfect fit in all the slides. The square thread left-hand screws for slide-rest have eight threads per in.; are $\frac{1}{2}$ in. diameter; therefore, $\frac{1}{2}$ -in. holes must be drilled in front of saddle and top slide of rest, $\frac{3}{8}$ -in. holes at back of ditto.

The saddle screw at back end is fitted with $\frac{3}{8}$ in. lock nuts; in front end of screw a shoulder is left. The screw for top slide has a collar and plate in front, but no lock nuts, the adjustment being made with the screws and steel plate. The tool post is turned out of mild steel, and screwed to size in drawing. The handles for rack, nut, and slide rest are malleable, and supplied with the castings. They are fitted to ends of screws and spindles by square shanks filed on ends of spindles. Should any difficulty be found in screw-cutting the slide-rest screws or leading screw, they can be had with castings, finished complete with gunmetal nuts, at a reasonable rate. The lead screw brackets will be bored and planed, and fitted to bed. The lead screw being at hand, it will be put through the brackets, and, with the lathe bed in its side, the brackets with screw in will be clamped to bed. A scribing gauge will be used, and, working from top of bed, we first set the brackets so that the leading screw is parallel with *lip* of bed. When this is so, we set it parallel to *edge* of bed. Absolute accuracy is necessary in each direction. Brackets are bolted to bed, when correct position has been found, by two $\frac{1}{2}$ -in. set bolts in each. The screw should revolve freely, but without play. The leading screw is of mild steel, $1\frac{1}{8}$ in. diameter, with four threads per inch. The nut box will be fitted with gunmetal nut. This nut has V edges, and is fitted to slide up and down nut box. The inside front box is recessed at back to take a circular cam plate. This plate has two parallel slots filed out. A short spindle is fitted to the bored hole in centre boss in nut box; the end of this spindle will be squared and handle fitted, a $\frac{3}{8}$ in. nut holding this firmly in place. Two steel pins, $\frac{3}{8}$ in. diameter, are in top half of nut, one in bottom half of nut. These pins engage in the slots in cam plate, which are, of course, $\frac{3}{8}$ in. wide. The nut box will next be fitted to the saddle by $\frac{3}{8}$ in. set bolts. Nut box must be bolted on quite square and parallel with bed. The gunmetal nut will be sawn in halves. Drill hole in top boss in nut box to take the pinion spindle; this will be turned out of mild steel.

The pinion is 12-pitch, having 21 teeth, and is keyed to spindle. The handle will now be fitted to spindle, which will have shank squared up to receive it. The rack will be fitted next in two or three lengths; facing pieces are cast on top and back of rack. These are to enable the fittings of rack to bed more easy of accomplishment. Rack is bolted to bed by set bolt through bed,

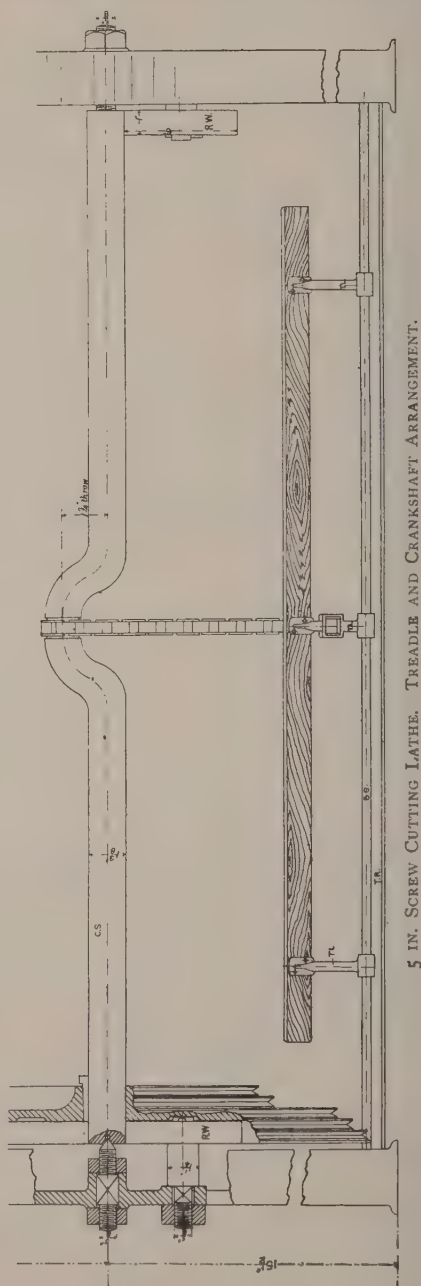


the bolt heads coming inside bed. See the rack is quite parallel with top of bed from bottom of teeth. The pinion must not be allowed to gear in too deeply in rack, or broken teeth will be the result. Carefully examine rack teeth in casting, and see if any teeth require filing before finally bolting to bed. The saddle may now be traversed up and down bed by the rack and pinion, the nut being opened wide enough to allow the leading screw to pass through the nut. It must be done very carefully and slowly at first to see if teeth gear properly, and to avoid a possibility of broken teeth through indifferent fitting of rack. Saddle must work quite smoothly, and without jar; and if it does not do so at first it will, perhaps, be found that the rack is a little too far down, and is gearing in to pinion too far at certain places. The standard will be fitted to bed, and should be planed on top surface and then drilled with 9-16th-in. holes through top plate; drill bed to correspond, and bolt up with $\frac{1}{2}$ -in. bolts and nuts. Drill a $\frac{5}{8}$ -in. clearing hole through bottom boss on bottom of each standard to allow the tie-stay rod to pass through. $\frac{5}{8}$ in. tapping holes will be drilled through the top bosses. $\frac{5}{8}$ -in. steel pointed centre bolts will be fitted to these, upon which the back shaft works.

The stay rod which goes through the bottom bosses is made from $\frac{5}{8}$ -in. steel rod, screwed up at each end for about 4 ins., or far enough to allow a $\frac{5}{8}$ -in. nut to screw on each side of boss.

The crankshaft, which for the 3 ft. 6 ins. bed, is a single throw, is made from $1\frac{1}{2}$ ins. steel turned to $1\frac{3}{8}$ ins.; but for the 4 ft. 6 in. bed a double throw crank will be advisable. The diameter of this latter will be $1\frac{1}{4}$ ins. when turned.

The throw of the crank is in each case $1\frac{1}{4}$ ins. It will be noticed that under the boss in centre of standard there is a slot cast; this slot has a stud made out of $1\frac{1}{2}$ ins. steel fitted to it and held by a $\frac{5}{8}$ in. nut on outside of standard. Upon the other end of stud is fitted a roller wheel 6 ins. diameter and 1 in. wide, on which crankshaft revolves; this plan reduces friction considerably and takes a great deal of the weight off the centres. The centres are made out of square cast steel, $\frac{5}{8}$ in. screws being cut. A square cored hole in centre of boss on standard prevents the centre turning round whilst being adjusted, $\frac{5}{8}$ in. nuts are fitted on either side of bosses. The 5-speed driving wheel it will probably be found cheaper to buy already turned and bored. In this case it will be necessary to turn the end of crankshaft to accurately fit the wheel. The slightest slackness in fitting, if allowed here would, when wheel was keyed to shaft, cause it to run out of truth. Key wheel to shaft almost the last thing of all, when treadle levers of board are all complete, and the wheel must be keyed to shaft in such a position that when the crank is a little over the dead centre towards you, the counter balance weight cast in run of driving wheel is at its lowest point. For the 3 ft. 6 ins. bed two plain, cast-iron treadle levers are required and one cored treadle lever; whilst for the 4 ft. 6 ins. bed two cored and one plain lever will be required. A double flanged roller casting will be turned to fit rather freely the oblong cored hole in treadle lever. A $\frac{1}{2}$ in. bolt and nut will be fitted, upon which the roller revolves. The groove in this roller should be a little over 1 in. wide, as also should be the width of crankpin, to allow a 1 in. chain to be used to connect to crank from treadle lever. The treadle motion being now completed, we turn our attention to finishing the swing plate, sleeves, change wheels, &c., and completing the lathe generally. The swing plate is a slotted casting bored out to fit the collar on left-hand screw bracket; stud bolt holes, $\frac{1}{2}$ in. tapping, are drilled in brackets, the $\frac{1}{2}$ in. bolts holding the swing plate in any position required by the varying diameters of the change wheels. The stud carrying



5 IN. SCREW CUTTING LATHE. TREADLE AND CRANKSHAFT ARRANGEMENT.

sleeve is turned out of a piece $1\frac{1}{2}$ ins. steel to sizes given in detail drawings, as is also the reversing plate stud, which was described in last article.

The sleeves are supplied as malleable castings; both must be turned the same size as end of leading screw, 1 in. diameter, so that when change wheels are bored they will be interchangeable. It will be noted that the stud for swing plate has a couple of flats fitted on to suit the slot in centre of swing plate, a nut and washer being fitted on the back to hold it in position. Keys must be fitted to sleeves and end of leading screw, $\frac{1}{4}$ in. square steel, sunk $\frac{1}{8}$ in. in sleeves will be the size. The key beds will be carefully chipped or milled out to $\frac{1}{8}$ in. deep by $\frac{1}{4}$ in wide; keys should fit lightly. Nuts will be fitted to end of studs to hold sleeves on by, and also large thin nuts to hold change wheels on sleeves and screw. The sleeve and leading screw will have fine thread cut on ends to take these nuts which are to be tapped $\frac{1}{2}$ in. gas thread, which is eleven threads per inch.

The change wheels are twenty-two in number of 12-pitch, ranging from 20 to 25 teeth rising by ones, and 25 to 100 teeth rising by fives; one 40-wheel extra. These wheels being cast from machine and metal patterns will not need much filing. They will be bored out on the faceplate of the lathe, great care being taken in chucking them to see that they run dead true on edge. Before commencing they will all be bored to 1 in. diameter and have keyways filed to suit the keys fitted to sleeves. The nose of mandrel should have a hole drilled up it $\frac{1}{8}$ in. diameter and then be bored out taper; a steel centre will be turned to fit, and it should have two small flats on to fit a spanner so as to be able to remove it from mandrel. The driver chuck will be bored, screwed, and finished.

The treadle board is preferably made from an even grained piece of wood, $1\frac{1}{2}$ ins. thick by $3\frac{1}{2}$ ins. wide. This is bolted to treadle levers by round-headed bolts. A gut band $\frac{1}{2}$ in. or 5-16ths ins. diameter, with a pair of steel hooks and eyes fitted will be used to drive by. The whole of the work done should be very carefully examined and any little adjustments made if found necessary. The lathe will now be ready for use and its owner will have, I trust, many pleasant and profitable hours with it.

Any further details or information, if needed, the writer will gladly furnish, either personally or by letter.

The Society of Model Engineers.

THE monthly meeting of the Society of Model Engineers was held in the Board Room, Memorial Hall, Farringdon Street, E.C., on Thursday, March 9th, about sixty-five members and friends being present. As usual a number of very interesting models and apparatus were displayed, some of the items being especially noteworthy. Following is a brief list:

Mr. J. C. Crebbin exhibited a splendid model locomotive with Gooch valve gear, and adapted for burning either coal, oil, or spirits as fuel. This engine was much admired by those present. We hope to give a full detailed description of this engine shortly, with a photograph.

Mr. E. L. Pearce also showed a model loco., constructed with a view to embodying some of the best features of various real engines.

Mr. Solomon had his interesting model loco., "Bessborough," on view, and

Messrs. Whitney also showed a very complete model loco. with tender, head-lights, etc.

Mr. W. Brooks contributed a model vertical drilling machine with a simple and readily adjustable table. The worked being clamped down on this, could be shifted to

any position at once under the drill, and the table instantly and securely locked by a simple turn of the handle.

Mr. W. Martin sent a smart nickel-plated model of a vertical steam pump, the steam cylinder being about $\frac{3}{8}$ in. bore by $\frac{3}{4}$ in. stroke.

Mr. Rompler exhibited a telephone station, made with some alterations from the descriptions recently published in THE MODEL ENGINEER. The receivers were made with compound magnets, and the transmitter was of the Hunnings pattern. Mr. Rompler has two such stations, and speech is very clearly and distinctly heard.

Mr. H. Hildersley caused much amusement by working a magneto-machine, and supplied the company with electric shocks.

At eight o'clock Mr. PERCIVAL MARSHALL took the chair, and called upon the secretary to read the minutes of the previous meeting. Formal business being disposed of, the Chairman announced various additions to the library, the latest being "Dynamo Attendants and their Dynamos," kindly given by Messrs. Kentell & Co. Since this, however, the library has been increased by the addition of "Electricity and Magnetism," by Sylvanus P. Thompson, presented by Mr. Pennington, "Great Western Expresses," by P. J. Vinter, and "Minute Expresses," by Rev. W. J. Scott, presented by Mr. J. C. Crebbin; also "Commercial and Domestic Telephony," presented by Mr. F. G. Bell, of the General Electric Co.

It was then announced that the committee had further considered the subject of competitions, and had drawn up the scheme which we print at the end of this report.

The CHAIRMAN next called upon Mr. Stanley J. Harding to deliver his lecture on

THE WIMSHURST MACHINE.

Mr. HARDING introduced his subject by mentioning some of the leading facts in regard to electrical induction, and very quickly proceeded to practical demonstrations himself with his machine. This was originally constructed by Mr. James Winshurst, had eight 15-in. plates, and was enclosed in a glass case. The lecturer explained that while the use of a large number of plates did not materially enhance the length of the spark, the thickness and continuity were much improved, and the machine was easily got to work. A most interesting and practical lecture was brought to a close with some remarks on the probable actions taking place while the Winshurst machine was at work.

A hearty vote of thanks, proposed by Mr. W. J. TENNANT, and seconded by Mr. J. C. CREBBIN, was accorded to Mr. Harding and to Messrs. Lowne, who assisted in all the experiments.

Mr. LOWNE was then called upon to explain his atmospheric engine, and a practical demonstration of its capabilities was given by connecting the gas supply and driving a dynamo, which supplied two incandescent lamps with current.

THE NEXT MEETING.

The next meeting of the society will be held on Friday, April 7th, at the Memorial Hall, Farringdon Street, E.C., when Mr. Percival Marshall will read a short paper on "Tools for Metal Turning." Mr. J. C. Crebbin will give a detailed description of his new model locomotive, and will also read a paper on "A Proposed Design for a Model Locomotive of $3\frac{1}{2}$ in. Gauge." Among the exhibits promised are a model of a Midland locomotive from Mr. Walter Alcock, and a hand-driven dynamo from Mr. E. L. Pearce.

PROVINCIAL BRANCHES.

BRADFORD.—A branch in this district was formally inaugurated at a meeting held on March 8th, Mr. John Hey, of 14, Balfour Street, Bradford, being elected

secretary. On this occasion some photographs of one of Mr. Spicer's engines, coupled to a dynamo made by the Model Supply Company, were exhibited, and Mr. A. P. Drake read an interesting paper on "Small Accumulators." The next meeting will be held on Monday, April 10th, at 7 p.m., at the Tyrell Street Coffee Tavern, Bradford, when all interested in model engineering matters will be welcomed.

SIEFFIELD.—Just as we go to press we hear that a Sheffield Branch has been successfully started with Mr. G. H. Rooke, School House, Handsworth, Sheffield, as hon. sec. We hope to give further particulars next month.

RAMSGATE.—Mr. H. Setterfield, of 2, Chantry Villas, Grange Road, Ramsgate, will be pleased to hear from MODEL ENGINEER readers in his district, with a view to forming a branch.

MISCELLANEOUS NOTICES.

Country members sending for books from the library need not forward their membership tickets. Stamps to prepay the postage on the desired book must, however, be enclosed.

The circulating portfolio, recently established for the benefit of country members, is now on its first round. Members wishing to have their names placed on the list for receiving same should communicate with Mr. James C. Crebbin, 3, The Grove, Muswell Hill, London, N.

COMPETITIONS.

The committee have decided to offer prizes for the best models of the following classes:—(1) locomotives; (2) marine or stationary engines; (3) electrical apparatus; (4) miscellaneous models. A gold medal will be given for the model considered by the judges to be the best of all those exhibited, irrespective of class; and a silver medal will be awarded to the best model in each of the other classes. An extra medal, irrespective of class, will be awarded for the best model made by a member under 21 years of age, and another medal will be given for the best model exhibited by a provincial member. The rules so far decided upon are as follows:

1. Each competitor must have been a member of the society for at least four months prior to the closing date for entries, or must have joined the society for at least one year in advance.

2. No member who is professionally engaged in model-making will be allowed to compete in Classes 1, 2, or 4, and no member who is professionally engaged in electrical-apparatus making will be allowed to compete in Class 3.

3. Subject to rule 2, any member is at liberty to compete in each or all of the classes.

4. The entrance-fee for each class is 1s., payable at time of sending in entry.

5. Each competitor shall, at the time of sending in his entry, state his full name and address, occupation, age, and date of joining the society. He shall also give the principal dimensions, and explain the details of construction of his model, giving rough sketches where necessary, and shall sign a declaration stating to what extent the model is his own handiwork, and what are its capabilities as to actual work or output. Special printed forms for giving the foregoing particulars will be provided, and will be obtainable from the hon. secretary.

6. The decision of the judges must in all cases be regarded as final, and they will have the right to withhold any of the medals, or to disqualify any exhibit if they see sufficient cause.

7. The closing date for entries is December 31st, 1899, and the awards and exhibition of the competing models will take place probably early in February, 1900.

Further particulars will be announced in due course.

The Editor's Page.

THE entries for our competition No. 5, in which we offered a prize of £2 2s. for the best article on "How to Build a Model Sailing Yacht," have been fewer than we anticipated, and consequently do not afford much scope for comment or criticism on our part. We have found that two of the competitions stand out as being better than any of the others received, though as regards these particular two there is little to choose between them as to merit. We have, therefore, thought it best to divide the prize, and to award £1 1s. to each of the following:

Mr. GEOFFREY GEORGE WACE,

Field Side,

London Road,

Shrewsbury;

and

Mr. GEORGE R. SCOTT,

13, New Market Street,

Ayr, N.B.

The competitions sent by "H. V." (Hampstead), and E. B. H. (Torquay) are worthy of commendation. The first of the winning articles will appear next month, and the other in a later issue.

* * *

The paragraph which we inserted last month, inviting communications from readers who wished to see some model yachting matter inserted in the journal, has brought us a fair number of letters in response, most of the writers being very enthusiastic in their support of the proposition we made. Whether a supplement would be of sufficient interest to our readers generally for us to make it a permanent feature of the paper is a matter to be proved, but we intend, in our next issue, to add some additional pages of model yachting matter as an experiment. We shall be pleased to hear from readers who can contribute suitable practical items concerning model yacht building and sailing, and also to have reports from secretaries of model yacht clubs as to the doings of their members. Readers who have model yachting friends will also confer a favour by making known to them this new departure in our editorial programme.

* * *

"W. H. R." (Ulverston) writes us that he would be glad to meet with one or two readers of this paper in his district, for the purpose of talking over model engineering matters of mutual interest. If any readers in the neighbourhood of Ulverston who wish to communicate with "W. H." will forward their addresses to us, we shall be pleased to send same to our correspondent.

* * *

We would direct the special attention of our readers to the competitions now being organised by the Society of Model Engineers, of which full particulars are given in another column. These competitions offer an opportunity of gaining no little distinction in the model-making world, and if a good number of entries are obtained, the competing models will enable a most attractive and instructive model engineering exhibition to be held.

"T. M." (Crewe) in a long letter on the subject of paying for price lists, raises an oft-debated point. He says:—"When I get each copy of THE MODEL ENGINEER, I read it through from the beginning to the end (from cover to cover), and I might add I take a great interest in electricity. Therefore, I read all the advertisements, and I am very sorry to find that there are so many advertisers who charge a penny stamp, or two or three penny stamps, for their price lists. I pass all these by for this reason; if an advertiser is not able to give his list free, there is something wrong somewhere; in fact, he might be making trade out of the stamps sent for lists. I have sent, perhaps, hundreds of stamps for lists, and many have been on single sheets, the cost of printing which would be about 4s. per thousand. This, after the halfpenny stamp is paid for to send list, will leave nearly £1 profit. Now, Mr. Editor, coming to the point, I think that if the price lists were all free, the advertisers (of whom, I am proud to see, you have so many) would do a much larger trade in selling their goods. I believe that there are some readers who send for these lists and never intend to buy at all, and if this is so, it is a shame the many should suffer for the few. I am pleased to see you have some advertisers who do not charge. These I patronise, and when their lists arrive, I compare all together and buy just what suits me."

We think our correspondent is hardly fair to the majority of our advertisers in the remarks we reproduce above. In many of the cases where the lists are single sheets, they are sent free on application, while in others all that is asked of the reader is a single stamp for postage. In the cases of the more elaborate catalogues, some of them running to fifty or sixty pages and even more, the fact must not be overlooked that these lists are very expensive to get-up. Not only is the cost of paper and printing considerable, but there is a very heavy outlay necessary to prepare all the engravings of the illustrations, a single block frequently costing £1, and sometimes £2 or even £3 to produce. The small amount charged for these lists in some cases does not cover the cost of production, and the advertiser is out of pocket on every list sent out. It is not an uncommon thing for an advertiser in THE MODEL ENGINEER to receive over a hundred applications for his list in the course of a month, so this is an item of expenditure which he must closely watch. We believe all our advertisers who charge anything beyond the mere stamp for postage are always willing to allow the cost of the price list to be deducted from the amount of the first reasonable order they receive from a customer. As our correspondent suggests, there are people who make a hobby of catalogue-collecting, and we think our advertisers are quite right in protecting themselves on this point if they choose so to do.

Apogee of the question of writing for catalogues, will our readers kindly remember that the postage on letters to the United States is 2½d., and on post-cards it is 1d.

We are asked to insert a reminder on this subject by our friends the Carlisle and Finch Company, of Cincinnati, who write to say that they have had so many replies to their recent advertisements in our pages which were not sufficiently stamped, that they have had to pay over ten dollars in excess postage alone on these communications.

In response to many inquiries, we take this opportunity of announcing that we shall shortly issue in book form Mr. W. J. Tennant's excellent articles on "The Slide Valve." The book, which we hope to have ready early in April, will contain an extra chapter and also several original illustrations in addition to the matter which has already appeared in these pages. It will form No. 2 of THE MODEL ENGINEER series of handbooks, and the price will be 6d. The book will be on sale at our usual agents, or may be ordered through any bookseller or newsagent.

New Prize Competitions.

COMPETITION No. 6.

A PRIZE OF £2 2s. is offered for the best article on "HOW TO MAKE A MODEL ELECTRIC MOTOR CAR."

This should be accompanied by complete working drawings, showing the construction of the body and wheels of the car, and also the details of the motor, accumulator, and gearing, etc.

The closing date for this competition is April 30th. (See General Rules.)

COMPETITION No. 7.

TWO PRIZES OF £1 is. each are offered for the best descriptions of how to make a working model suitable for driving from a small engine or gas engine, or electric motor. The model described may be a miniature machine tool, crane, pump, or agricultural machine, printing press, or any mechanical model with which the competitor is familiar. Full working drawings should accompany the description.

The closing date for this competition is June 30th. (See General Rules.)

GENERAL RULES

The following rules apply to all of the foregoing competitions:—

(1.) Any reader may enter for each and all of the competitions, but each article, with its drawings, should be sent under separate cover, and should be marked on the outside with the number of the competition to which it belongs.

(2.) All articles should be clearly written on one side of the paper only, and should bear the full name and address of the sender.

(3.) All drawings should be made in Indian ink on white cardboard, and should show all necessary dimensions in plain figures. No coloured lines or washes should be put in. Each drawing should bear the full name and address of the sender on the back.

(4.) Competitors desiring their work returned, in the event of it being unsuccessful, should enclose stamps for that purpose.

(5.) The Editor reserves the right of printing any of the unsuccessful competitions which he may consider worthy of publication.

(6.) All competitions should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.

(7.) The Editor's decision must be considered as final.

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.]

Small Tools for Model Work.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Replying to your correspondent, "T. M.," a drill should vary from soft at the shank to hard at the point, and this can only be obtained by heating the shank end first, gradually allowing the heat to reach the end, and then cooling out. If tempered on a plate, the thinnest part—the cutting point—is apt to become soft first. With regard to the first letter from "S. C.," re small face plate, this should be used only for very small work, otherwise the force might twist the plate round and spoil the centre hole. It would be better to have a duplicate nose-end on the barrel, to fit the face-plates belonging to the fast head.

F. W. SHAW.

Hebden Bridge.

A Simple Coil Winder.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I enclose a sketch of a simple coil winder I have made and used successfully. The coil to be wound is placed on the wooden axle AB, which takes the place of the core. This axle is turned by handle B. A threaded rod (CD) carries a loose nut (E). This threaded rod is rotated by the pulley D with a band passing from it to rod AB. The rods AB and CD are put in suitable bearings so as not to slide about. The bobbin of wire P slides about on a rod so as to follow the nut E, as wire is required.



Supposing threads on CD to be 18 to inch and the secondary wire No. 38 S.W.G., the relations of D to B¹ may be 5 to 1. A little space may thus be left between each strand which may be filled with varnish or wax. The belt G should be of elastic and the revolutions of D can be reversed by crossing belt G when a layer is finished.—Yours truly,

Luton.

Electric Clock Alarm.

TO THE EDITOR OF *The Model Engineer*.

SIR,—With reference to "Examiner's" letter in your February issue re Electric Alarm Clocks. If my idea was an old one, that is no reason why it should not be good, and it may be new to a good many readers. I have fitted up clocks—and valuable ones, too—on this principle, and have found them to work perfectly satisfactorily, and have never known the timekeeping qualities to be affected in any way. For my part, I don't see how a clock so fitted would lose time. I think that rather a funny idea of "Examiner's" about a clock being magnetised; perhaps

he will explain how it is brought about, as I am unable to see how the current from two or more cells, running through the works, could do it. I notice also, in this month's issue, that the descriptions of fitting up alarms by other readers, that the current runs through the works in every case, and I daresay the owners do not find any difficulty about the clocks keeping time. No doubt the method of fitting up an alarm given by "Examiner" is very good, but I, for one, could not see how it was to be fixed, there being no explanations given; it appeared to me too complicated a contrivance, as the more simple a device is, the better, being much less liable to get out of order. That was the reason I gave your readers a good and reliable method to fit up a clock that could be depended on, and at no cost. I am indebted to "W. J. A. L." for calling my attention to an omission, which, I should have added; I was thinking of clocks in wood cases when writing, and should have included what he suggests.—Yours truly,

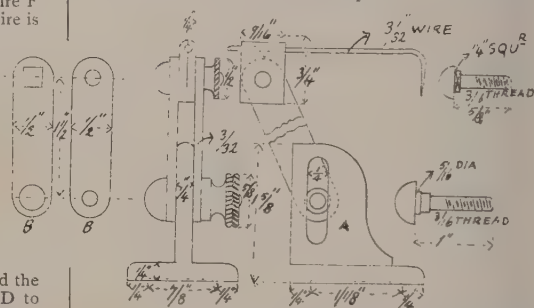
"AMATEUR."

Llanely.

A Useful Scribing Block.

TO THE EDITOR OF *The Model Engineer*.

SIR,—The following description of a small scribing block which I have just completed may be of interest to amateur mechanics and others. It can be used in positions where the long stem pattern cannot, and also makes a fine depth gauge. The base is made from a piece of $1\frac{3}{4}$ in. by $1\frac{3}{4}$ in. by $\frac{1}{2}$ in. T section steel, cut off to the length shown, and the corners filed out square. Chip out the under-side as shown in the sketch. Mark out the shape of the web A, and file down to the marking out lines. Drill a number of holes along the slot, and break one into another, afterwards filing up to sizes shown. The two links are cut from steel plate, and finished with



the file, as shown. Drill one of them with two 3-16ths in. full holes to pass over the screws, and the other one with a 5-16ths hole one end and a $\frac{1}{4}$ in. square the other. The needle holder is made from a piece of $\frac{3}{4}$ in. by $\frac{1}{2}$ in. steel doubled down itself, and finished as dimensions given. The screws are turned from mild steel, and require but little explanation, as sizes are given. The side elevation shows one of the links removed, to show how the bottom screw is prevented from turning round when tightening up. The needle is shown broken off, but must not be too long, or it will not be rigid. Ordinary wing nuts may be used in place of the nuts shown, but do not look so nice. To those who do not care to go to the expense of a metal surface plate for marking out on, allow me to recommend a piece of $\frac{1}{2}$ in. plate glass of the size required let into a piece of 1½ in. pine, or other soft wood. With this and the block described, the amateur engineer should be able to do a great deal of marking off.—Yours truly,

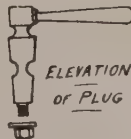
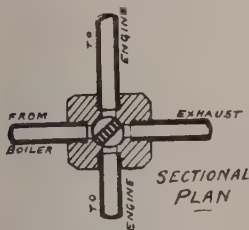
Clapham.

E. W. F.

Reversing-gear for Oscillating Cylinders.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I enclose sketch of above, which is to my mind simpler than "A.P.D.'s" only one exhaust being required. It is simply a four-way tap, the plug having a "web" instead of a hole through it. The thickness of the web



should be made the same width, or a trifle wider than the ports in the body of the tap, it will then completely shut off steam when required, and there is no necessity therefore, to have a steam tap as well.—Yours truly,

Balham.

W. B. H.

Soldering Zinc.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I had the same difficulty in soldering copper to zinc that "W. O." writes of, but after a number of trials I find the following plan satisfactory. Clean the copper and zinc at the places where they are to be soldered; place a piece of solder about the size of a split pea on the cleaned zinc, lay the end of the copper wire beside it; paint the parts with "killed spirits"; place a spirit lamp under the solder until it melts, the solder will run on to both copper and zinc; withdraw the lamp, and quickly grasp the copper and zinc in a pair of tweezers until it sets.

I also fixed wire to the carbon plate thus: At the top end of the carbon plate drill a hole vertically downwards, making it wider at the bottom than at the top; put some solder into this hole; melt it with a blowpipe, and, before it cools, thrust the cleaned end of a copper wire, previously dipped in "killed spirits," till the solder melts.

Musselburgh.

J. H. H.

On Saturday, March 11th, the Institution of Junior Engineers held a most successful conversation at the Westminster Palace Hotel, London, the guests being received by Sir William and Lady White, and Mr. B. H. Joy and Mrs. David Joy. A capital cinematograph display by Messrs. Prestwich, a lantern lecturette entitled, "A Yarn of the Sea," by Mr. Basil H. Joy, the electro-phon, and instrumental and vocal music were among the items in the entertainment list. A capital collection of models were on view, including several vessels of the Orient, Cunard and P. & O. lines, a splendid model of H.M.S. "Powerful," model launch engines by Messrs. Des Vignes & Co., models of L. N. Ry. steamers, photographs of the "Turbinia," models of ship-fittings by Messrs. Paxton & Co., models of G. E. Ry. loco boiler and valve gear, model of Babcock and Wilcox boiler, etc. The Society of Model Engineers were well represented by model locomotives lent by Messrs. Crebbin, Solomon & Alcock. Mr. H. E. Morriss showed a very well-designed portable auxiliary propelling apparatus for boats and small craft, which he has recently invented, and which aroused considerable interest by its neat appearance and arrangement.

Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to THE MODEL ENGINEER, 6, FARRINGTON AVENUE, LONDON, E.C.]

The following are selected from the queries which have been replied to recently:—

[642] **Small Electric Light.** "Novice" writes: I want to fit up a small electric light in a bedroom, to light for 5 or 6 hours if necessary. Will you please let me know what are the requisite parts for doing so? It is essential there should be no noise, therefore the simpler the better.

The only feasible plan that will meet your requirements will be for you to procure a so-called "Q" type battery (accumulator) from the F.P.S. people, and have it charged occasionally from some central electric station. A good 8-volt lamp of about 5 candle-power, could be run from this for about a week at a stretch. No other way would possibly be of any use, as a dynamo (owing to the noise) is out of the question, while primary batteries want constant attention and renewal.

[651] **Simplex Dynamo.** T. F. (Solihull) writes: Will you kindly tell me with what number of B.W.G. wire I must wind the field magnet and armature of a simplex motor, to work with 4 volts, 2 amperes, and to run at as high a speed as possible? The size of the armature core is 2½ ins. long, ½ in. thick, and that of the field magnet core 1 in. long and ¾ in. thick. The above motor is to work a boat 2 ft. long and 6 in. beam. What size screw should it work with?

You do not state the type of your armature. Presuming from the dimensions that it is a Siemens', your end will be served if you wind the armature with about 3 oz. of No. 24 silk and the F.M. core with about ¼ lb. No. 18 silk, connected up in series. The largest screw you could work with the power at your disposition would be one of 2 in. in diameter.

[650] **Water Resistance, etc.** R. S. (Truro) writes: I have been trying to make a water resistance for an electric light to work from a dynamo, 32 c.p., 20 volts. If you could give me full instructions how to make same, I should be able to go through my work as a pastime. (1) Which would be the cheapest—to make or buy an accumulator for dynamo I have mentioned. If making one myself, give me instructions for same. (2) One that would—with once charging—last a week, with one 8 c.p. lamp, and 100 revolutions per hour per week. (3) Give me cost of accumulator to make and how long would it take to charge. (4) And also cost to maintain every charge (in acids, &c.). (5) Give name of manufacturer of accumulators. The dynamo is Manchester type, and runs at 2,500 revolutions per minute.

With so small a dynamo as you mention, a resistance would hardly ever be needed; but the following will give you every satisfaction. Procure a glass tube, 6 in. long, about ¾ in. bore. Fit to it two soft, well-fitting corks: soak these in melted paraffin wax until bubbles no longer appear. Perforate the corks centrally with a small hole, sufficient to take tightly a piece of No. 14 copper wire. Procure two pieces of No. 14 copper wire, 6 in. long; solder a small terminal to one extremity of each; pass the free ends of the wires through the apertures in the corks. Having placed one cork and its wire in the tube, fill the tube nearly full with about 5 per cent. solution of common washing soda in water; now replace the other cork, allowing the wires to stand about 1 in. apart. At this distance the resistance will be about 250 ohms, and it can be decreased to any desired extent by pushing the wires nearer to one another. (1) You can buy an accumulator at the rate of about 4s. 6d. per cell. You could make them cheaper, but probably your first attempts would not be successful. See, for full details, our little sixpenny book, "Small Accumulators," in THE MODEL ENGINEER SERIES, for full instructions for making these. (2) The size required to light an 8 c.p. lamp of, say, 20 volts, for thirty hours, would be about 10 cells, containing three plates, each 6 in. by 4 in. (3) Home-made, this would cost 25s. (4) As the acid does not require renewing, no expense would accrue from this; but, of course, the mere fact of having to drive the dynamo will entail expenditure at the rate of about 4d. per kilowatt-hour, through our advertisements for names of manufacturers of accumulators.

[656] **Plating Dynamo Required to Use for Lighting.** E. T. W. R. (Painswick, Gloucester) writes: At the works I am connected with a dynamo is used for plating which generates a current of 250 amperes at 6 volts. (I can reduce amperes to anything with resistance board fitted; but the voltage is also reduced.) Please answer the following questions:—(1) Is this current of any use for lighting purposes as it is? If so, what class of lamp? (2) Can I transform this into current suitable for lighting on a large scale? What is the price of transformer? (3) Can this current (amperes reduced to about 5) be stored in small accumulators suitable for lighting bicycle lamp, or table decorations, and for driving

motors? As this is only used for about half the day, I could have the benefit of 3 c.p. current if you could.

You could light up 250 lamps at 5 volt, about 2 c.-p. in parallel, which would be equal to about 500 c.-p. (2) You could not exactly transform this current since it is not alternating, but you might use a "booster" or "motor dynamo," costing about £20, which, by being driven as a motor from your dynamo, would give current at a pressure of 50 volts and perhaps 20 amperes, and thus enable you to light 20 lamps at 16 c.-p. each. But the loss in the double transformation is pretty large—from 30 to 40 per cent. (3) Using the dynamo without any resistance in circuit, the back E.M.F. of 2-volt accumulators cells in series would be quite sufficient and pull down the current to within charging limits. If you cared to go in for charging a large number of these small accumulators, you might arrange to charge 250 in parallel at once.

[666] **Overtype Dynamo.** J. H. H. (Snybridge) writes: Kindly describe an overtype dynamo to light five 8 c.-p. lamps at 25 volts. A rough sketch showing outline of machine and giving sizes will oblige. Also speed required and sizes and amount of wires on armature and field magnets.

An overtype dynamo, with drum armature to light five 8 c.-p. 25-volt lamps, should have an armature $2\frac{1}{2}$ in. diam., 5 in. long, built up of laminations. There should be 12 divisions or cogs on this armature, which should be wound as a drum, with about 1 lb. No. 20 D.C.C. The accumulator should have 6 segments. The field magnet, including the pole pieces, should stand about 6 in. high and be 1 in. thick, 5 in. long. The tunnel should embrace about two-thirds of the armature, nearly 3 in. in diam., but should be bored out to just clear the wound armature; the closer the armature runs to the pole pieces without actually touching, the more efficient will the machine be. The F.M.s should be wound with about 4 lb. No. 20 on such limb, and be connected in shunt with brushes. Speed, about 2,500 revolutions per minute. You will find sketches and description of a machine of this type, with very full directions for winding and connecting up a drum armature, in Bottone's "The Dynamo."

[668] **Port for Horizontal Steam Engine.** H. A. R. (Leeds) writes: I am making a horizontal steam engine, $1\frac{1}{2}$ in. bore, 2 in. stroke. Would you kindly give me the sizes of steam and exhaust ports and the travel of valve? I want the engine to give as much power as possible; also height and diameter of copper boiler to steam the engine, the thickness of copper, and the number and size of tubes; I do not want to have water space round firebox. Also the diameter and distance apart of rivets. I should like to work the boiler at about 50 lb. pressure?

Steam ports, $\frac{3}{4}$ in. by 1-8th in. wide; bridges, 1-8th in. wide; exhaust ports, $\frac{1}{2}$ in. by $\frac{1}{4}$ in.; travel of valve, $\frac{3}{8}$ in.; lap, 3-32nds in.; length, 15-16ths in.; width, 1 in.; cavity in valve, $\frac{1}{4}$ in. by $\frac{1}{4}$ in. deep; boiler, 9 in. diam., 15 in. high; copper, 3-32nds in. thick; tube plates, 1-8th in. thick; 13 tubes, 1 in. diam.; inside, 15 in. long; rivets, 3-16ths diam., $\frac{1}{4}$ in. apart.

[669] **Cylinders for Model Locos.** F. H. L. (Kingswear) writes: I am making a model locomotive, and should be glad if you could tell me the size of cylinder I ought to have? The boiler is of my own, and its cubic capacity is about 45 cubic in.; the heating surface is about 28 square in. I want to have two oscillating cylinders and do not know what size I ought to get them. The model will weigh a little over 12 lb. when finished. I shall be very obliged, if you will give me the bore and stroke that my cylinders ought to be.

If driving wheels are 3 in. or less in diam., cylinders $\frac{1}{2}$ in. bore and 1 in. stroke will do. For 3½ in. wheels use cylinders 5-8ths in. bore and 1-8th stroke.

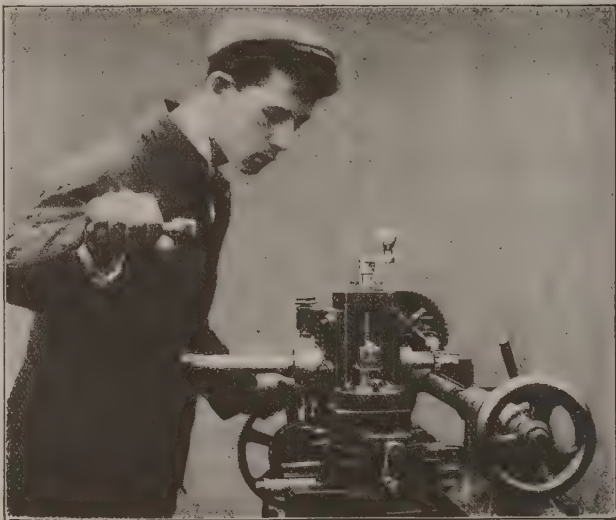
[670] **Dynamo to Light Five 16-c.p. Lamps.** C. F. (Clitheroe) writes: (1) What would be the cost (approximate) of a shunt-wound dynamo, giving at 2,000 revolutions per minute, 8½ amperes at 35 volts? (2) Would it be sufficient to light five 16-c.p. lamps? The distance from the lamps to the dynamo would be 30 yards. (3) How long would it take to charge accumulators to light five 16-c.p. lamps for four hours? What would be the cost of the accumulators? (4) The wire connecting the dynamo to the lamps or accumulators would have to cross from one building to another, a distance of 10 yards, and 16 ft. from the ground. Would the covering on the wire be damaged by continual exposure to rain and sun? What kind of wire should be used?

(1) About £10. (2) The output of dynamo is barely sufficient to light five 16-c.p. lamps. If you want to charge accumulators with the same dynamo, it would be best to use 25-volt lamps. You would require fourteen cells. (3) It would take six or seven hours to charge

cells; they would cost about £12. (4) Get the best insulated copper wire for outside use, either a single No. 12 wire, or 7-20 stranded. Covering would not be affected by the weather. You could light about eight 8-c.-p. 25-volt lamps.

[673] **Midland Passenger Loco.** W. M. (Hinckley) writes: Having two small slide valve cylinders, $\frac{1}{2}$ in. bore, 1 in. stroke, I intend making a loco of Midland passenger type. Will you kindly give relative sizes of boiler, funnel, cab, and wheels? I have a brass plate 15 by 4½ ins., which I thought would do for bedplate. I want the model, when finished, to have an exact resemblance to the real engine.

Barrel of boiler, $2\frac{1}{2}$ in. diam., $5\frac{1}{2}$ in. long; outside firebox, 3 in. long, $2\frac{1}{2}$ in. wide; inside firebox, $2\frac{1}{2}$ in. long, $1\frac{1}{2}$ in. wide, 3 in. deep. Put in five tube tubes, $\frac{1}{2}$ in. diam., from firebox to smokebox. Height of bedplate from rails, 2-8th in.; centre of boiler from rails, 3-7-8th



MESSRS. J. SMART & CO.'S LATHE MILLING ATTACHMENT.

(For description see opposite page.)

in.; top of chimney from rails, $6\frac{1}{2}$ in.; diam. of chimney, $\frac{1}{2}$ in.; height of cab from bedplate, $3\frac{1}{2}$ in.; width, 4 in. Length of frames, $14\frac{1}{2}$ in.; bogie wheels, $1\frac{1}{2}$ in. diam., $3\frac{1}{2}$ in. centre to centre; centre of bogie to driving wheels, 5-18th in.; centre of driving wheels to trailers, 4-3-8ths in. Diameter of driving wheels, $3\frac{1}{2}$ in.; gauge of rails, about 3 in.

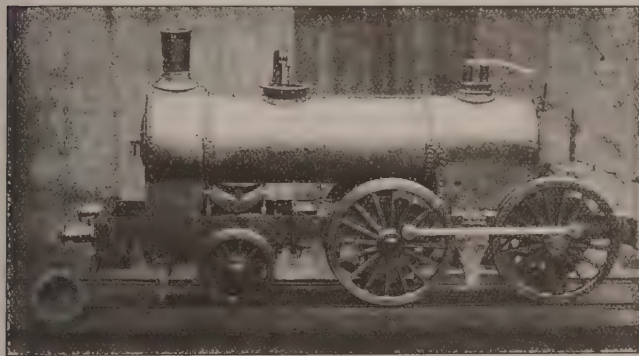
[674] **Steam, Gas, Oil, and Hot Air Engines.** W. R. (Blackwood) writes: I am about to make a horizontal steam engine with above piston forces it done. An oil engine works exactly in the same way to a gas engine, with the addition of a vapouriser, which is made hot by a blast lamp. A small quantity of oil is forced into vapouriser, and converted into an oil gas; it is then drawn into cylinder with a charge of air, compressed on the return stroke, and fired at the commencement of the next outward stroke. The vapourised oil takes the place of the gas used in a gas engine.

[675] **Oscillating Cylinders for Loco.** L. A. B. (Chingford) writes: Could oscillating double-action cylinders drive a locomotive 20 in. long, steam pressure 10 lb. to the square inch? Cylinders would be $1\frac{1}{2}$ in. stroke, 1 in. diam., driving wheel 5 in. diam. How are oscillating cylinders made to reverse?

The cylinders should drive the engine, if it is not too heavily built and all working parts move easily. The steam pressure is rather low. Oscillating cylinders can be reversed by employing an additional steam chest, with a slide valve and three ports, similar to that in slide-valve engine. One steam port leading to the upper ports in cylinder steam chest, the other steam port leading to the lower

ports. The valve is moved by a rod passing through a stuffing-box, and connected to reversing lever. When the valve is in the mid-position, the engine is stopped. The same object can be attained with a four-way plug tap. The sketches on page 77 will explain the arrangement. See also reply to Query No. 598.

(69) **Engine and Boiler for 1 H.-P. Motor Car.** F. G. R. (Brixton) writes: I should feel very much obliged if you would kindly enlighten me as to the following—Engine and Boiler for



"J. H." MODEL LOCOMOTIVE.

1 h.-p. motor car (non-condensing.) (1) Smallest boiler to run 50 miles, once filling; thickness of metal. (2) One, or two, cylinders; diameter and length of stroke. (3) No of revolutions per minute to obtain greatest power (speed obtained by gearing). (4) Is petroleum blast heat enough; say, 2 Bickford burners? (5) Could cylinder be built up with steel tube with brazed joint (as in article by H. E. Morris, No. 7, July, "soldered brass for models").

(1) To give out 1 h.-p., the boiler would have to evaporate about 5 gallons of water per hour. At a speed of 8 miles per hour the boiler must be large enough to hold about 30 gallons of water for a run of 50 miles. This would be too heavy for motor car work. It would be preferable to use a light quick steaming boiler, and pump feed water in as required. A boiler to work at 100 lb., 16 in. diam. and 24 in. high, should have plates $\frac{1}{2}$ in. thick; firebox, 14 in. diam. at bottom and 12 in. at top, 16 in. high with six Field tubes. (2) Two cylinders, 2 in. bore, 4 in. stroke. (3) Revolutions about 300 per minute. (4) Yes; if the right size. (5) Yes.

(68) **Setting-out Plate for Taper Firebox.** J. W. C. (Polgate) writes: I wish to make a taper firebox for a model. Please send me a diagram showing how to set out the copper. The firebox is to be 11 in. diam. at bottom, 10 $\frac{1}{2}$ in. at top, and 7 $\frac{1}{2}$ in. deep, to be used in a vertical boiler and will be cylindrical in horizontal section.

Set out a full size vertical section through firebox and continue the taper lines t.t. until they meet, and at that point strike curves through he points A.B. and C.D. and for an equal distance each way, and add a margin for the lapped joint.

Amateurs' Supplies.

[The Editor will be pleased to receive for review under this heading samples and particulars of new tools, apparatus, and materials for amateur use.]

Soldering Aluminium.

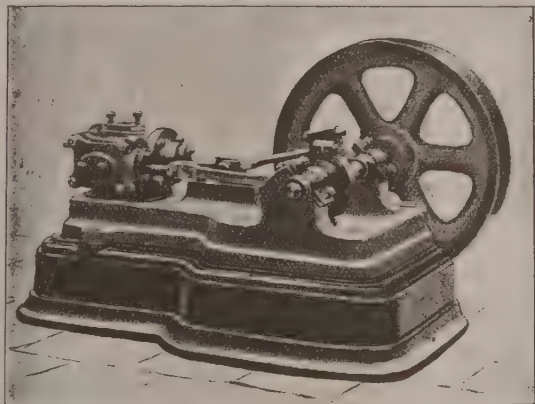
Mr. C. Ford, Dibble's Place, Kingsland Road, St. Philip's, Bristol, sends us a specimen of aluminium with a soldered joint, which, to all appearances, is as strong as can be desired. It is claimed that the secret is a special flux, which allows ordinary tinman's or other solder to be used with aluminium as easily as with brass or copper. Readers interested in the matter should communicate with Mr. Ford at above address.

A Simple Milling Appliance.

Messrs. J. Smart & Co., North End, Erith, Kent, send us a fully descriptive list of their improved milling and wheel-cutting attachment for the lathe. The apparatus, as we can testify from a personal inspection, can be readily and effectively used for all descriptions of small milling, such as fitting taps, making milling-cutters, cutting gear wheels, cutting keyways, ratchet wheels, etc. It is attached to the lathe slide-rest, and worked by a long lever handle, whilst the feed motion is given by turning the leading screw of lathe by means of the change wheel. Work up to five feet long has been done with this useful appliance, several views of which, as well as sketches of work done and much interesting information, are given in this sheet. Further particulars will be readily sent to readers of THE MODEL ENGINEER on application as above.

"J. H." Model Engine Castings.

We illustrate on this page two model engines of excellent design and material, castings and parts for which are supplied by Mr. Joseph Horner, 17, Vernon Terrace, Twerton-on-Avon, Bath, who is well-known as a writer of engineering text-books and as a contributor to technical journals under the signature "J. H." The set of materials for making the horizontal engine as shown, comprises 21 castings and 4 forgings, the cylinder being $\frac{3}{4}$ in. bore by $1\frac{3}{8}$ stroke. A simpler engine of the same size is also listed, as well as a vertical marine pattern engine. We have received a sample cylinder casting for the engine illustrated, and have found it to be particularly well moulded, the steam and exhaust parts being very accurately and cleanly cast in. We have also received samples of malleable cast iron loco. rails, and angle bars in iron and brass, as well as some model screws, bolts, rivets, &c., all being thoroughly well made. Our other illustration shows one of the "J. H." locomotives with cylinders 11-16ths by 2 $\frac{3}{4}$ in., and driving and trailing wheels 8 in. diameter. Mr. Horner also supplies castings and parts for two other types of locomotives. Full particulars and illustrations of these, and also of numerous miscellaneous castings, parts, fittings, &c., will be found in his price lists which will be sent free on application to anyone mentioning THE MODEL ENGINEER and sending stamp for postage. Our readers will find them interesting.



"J.H." MODEL HORIZONTAL ENGINE.

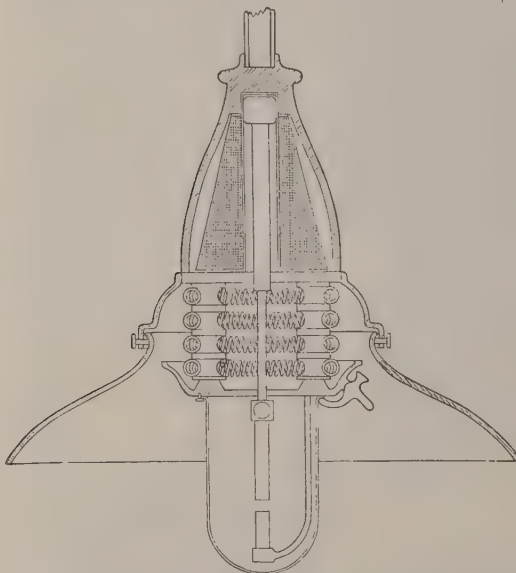
Dynamo Stampings and Castings.

We have received from Mr. A. W. Roy, a complete set of castings and amateur stampings for a 10 c.p. dynamo, for our inspection. We are pleased to state that the dynamo is a neat and efficient pattern, the field-magnets being of good soft cast iron and well proportioned. The sample before us is a sound and clean casting, and it is obvious that very little work will be necessary to fit up a useful little machine with the details supplied. These include brass

castings for bearings, commutator, brush holder and pulley, as well as the requisite number of eight cogged drum armature stampings. The whole forms a really cheap investment at the price quoted—3s. 6d. for complete set. From the same firm we receive a pattern stamping for field-magnet for $1\frac{1}{2}$ in. armature, a suitable armature stamping being also enclosed. There is no doubt that a motor made up with these stampings would be a very efficient machine indeed, and as the specimens submitted to us are clean cut, quite free from burrs, and provided with the proper bolt holes, they will take a minimum of trouble to put together. As will be seen from our advertisement columns, several other items of considerable interest to amateurs are amongst Mr. Roy's specialities, including water motors, acetylene cycle lamps, etc. His address is 151, Shields Road, Newcastle-on-Tyne.

The Stewart Lilliputian Arc Lamp.

In the last issue of THE MODEL ENGINEER we referred briefly to a specially neat arc lamp, which has been put on the market under the above title. We now publish a sectional view of the lamp, which shows clearly the simple nature of the construction, there being no



clockwork or complicated mechanism involved. It is stated that the lamp, while intended for direct currents at 100 to 120 volts, will work economically on circuits where the voltage is 150. Particulars may be had by mentioning this journal, from The Stewart Electrical Syndicate, 5, New Compton Street, London, W.C.

Spicer's Engine Castings.

Mr. Frank P. Spicer of Hillside, Prestwich, near Manchester writes as follows:—"As I have had many enquiries for sets of my high speed engine castings in brass, you kindly state that in consequence of arrangements I have made with a brass founder, I can now supply the sets for the same price as the aluminium castings—viz., 12s. 6d. per set.

American Model Locomotive Castings.

We learn from the Model Supply Co., of 14, Falfour Street, Bradford, that they have just been appointed agents in this country for Messrs Olney & Warrin's castings of model American locomotives. Price lists and full particulars can be had on application.

Plasticine.

Model makers who wish to make realistic castles, windmills, lighthouses, bridges, and other architectural matters, often find the need for an easily-worked substance which will combine the advantages of modelling clay with those of some less intractable material. This end appears to be attained in Plasticine, which, to all appearances, is much like modelling clay, but possesses the following great advantages over that substance. It always remains plastic, is clean, and does not stick to the fingers, gets better with age, has no smell, and retains any shape given to it. It is manufactured either in grey, blue, red, and yellow colours, and can be had in any degree of stiffness. Further information and prices can be obtained by any reader from the maker, William Harbutt, A.R.C.A., Bath.

Catalogues Received.

Campbell & Co., 116, Trongate, Glasgow.—We have received an attractive price list of musical instruments supplied by Messrs. Campbell & Co., which contains descriptions and remarks on a great number and variety of musical goods, melodions being a speciality. Those of our readers who are musically inclined would do well to communicate with this firm.

Frank Baker, 82, Vyse Street, Birmingham.—This is the fourth edition of Mr. Baker's useful price list of stamps, dies, engines, name-plates, engraved plates of all kinds, die-sinking, presses, etc. In fact, the number of items dealt with in this catalogue is surprising, comprising, in addition to the above, stencil-plates, name-plates, moulding letters, club badges, dating machines, seals, and so on. A large number of amateurs will find something interesting in this list, which will be sent free to any reader mentioning this journal.

C. A. Vandervell & Co., Thorpe Works, Notting Hill, London, W.—Several sheets descriptive of electrical goods are sent us by this firm, who make a speciality of small charging and other dynamos, and portable accumulators and lamps. One sheet is devoted to a line of electric cycle lamps; and volt- and ammeters are also in evidence. It is stated that the batteries have been on the market for six years and have given every satisfaction. Small gas engines are also a speciality with this firm. Lists will be sent free to readers if they will mention the particular ones they desire.

H. Jones, 14, High Street, Lambeth, S.E.—We have received lists of gas and oil engines and dynamos of various types from Mr. Jones. The engines are either vertical or horizontal, ordinary paraffin being consumed in the oil engines. Small dynamos, in the rough or finished, for plating or lighting, are quoted, and the fact that the firm has been established seventeen years is evidence of the reliability of the goods supplied. The lists can be had post free by mentioning THE MODEL ENGINEER.

George F. Harrison, 6, Manning Street, Nottingham.—These are new editions of three little handbooks on soldering, cycle brazing, and screw cutting, respectively. These appear to contain all the necessary information under the three heads which can be compressed into a small and handy booklet, and the three books are to be had for the sum of 1s. post free.

Thorpe & Salter, 17, Red Lion Street, Clerkenwell, E.C.—The makers of the "Ruby" Gas Engine send us a list giving the prices of various sizes of this engine, which appears to have given general satisfaction.

A. W. Roy, 151, Shield's Road, Newcastle-on-Tyne.—A neat catalogue of electrical and mechanical models and parts has been submitted by Mr. Roy, in which dynamos, motors, stampings, engines, lathes, and numerous castings, are set out in detail, the prices being carefully tabulated. Those about to build dynamos or engines should send for this list, which will be forwarded, post free, to any reader mentioning THE MODEL ENGINEER, for a penny stamp.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 3s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All correspondence relating to advertisements to be addressed to the ADVERTISEMENT MANAGER, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All subscriptions and correspondence relating to sales of the paper to be addressed to the publishers, Dawbarn & Ward, Limited, 6, Farringdon Avenue, London, E.C.

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THE
Model Engineer
AND
Amateur Electrician.

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EDITED BY PERCIVAL MARSHALL. A.I.MECH.E.

VOL. II. NO. 17.

MAY, 1899.

PUBLISHED
MONTHLY.

A Model Midland Express Locomotive.

WE are indebted for the accompanying photographs and details of the engine therein depicted to Mr. Walter Alcock, Mus. Bac., who may be known to many of our readers as the highly-talented organist who officiates at Holy Trinity, Sloane Street, S.W., and also occupies the responsible post of assistant organist at Westminster Abbey. Locomotive engineering is Mr. Alcock's hobby, and he is quite as keen and as well versed in the doings of the real engines as in those of models. That his own model is a fine piece of work we can testify as the result of a very interesting visit of inspection on our part, and we can also answer for its ability to pull a dead weight of some 14 st., for that task it easily performed when it pulled the Editor of the *M.E.* from end to end of Mr. Alcock's track. It is a point to be scored to Mr. Alcock's credit that he obtained his Mus. Bac. degree while this engine was in progress. Probably the mental relaxation gained in model-making helped him to pursue his musical studies to so successful an end.

But enough from the editorial pen. We will let Mr. Alcock tell us about his model in his own words. He writes:—"I began building engines at the age of 14. For the boiler I generally used a cocoatina tin, and made the oscillating cylinders of odd bits of brass tubing. My only tools were a soldering-iron, my mother's best pair of scissors, a file or two, a hammer, and a centre-bit, which latter, in conjunction with the handle end of a file,

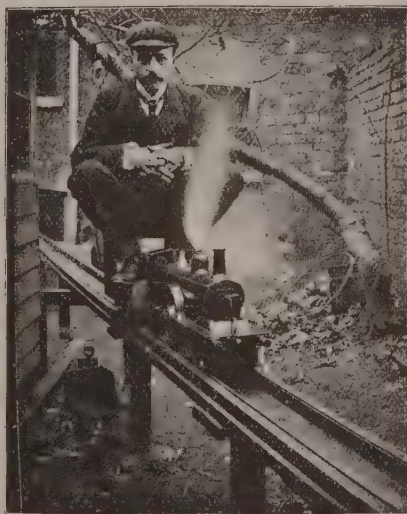
was used for boring holes! The engines thus erected were, on the whole, successful, but my ambition was to build an engine which would pull me along, and burn coal. The subject of this article is the result of that early determination. I began this engine in 1894, and though it is in some few details incomplete, it reached its present state in 1897.

"My first step was to try and obtain the working drawings, which I believe appeared in *Engineer* and in *Engineering*. I enquired at both offices, but found they were out of print. However, I at once decided to attempt the model without drawings. Many were the journeys I paid to St. Pancras, and innumerable the questions I put to the luckless drivers. But I got what I wanted—viz., the sizes of the wheels, length of engine, and wheelbases. I then started on the frames. These I made of 3-32nds in. brass sheet. The wheels were made and turned, axles fitted, and crankshaft supplied by Mr. Lewis, then of New Oxford Street, now of Bath House, Twickenham. The axle boxes I made from brass bars, cast square, and I always remember these as the hardest work of all, with little to show for it.

"Then came the cylinders. I built them up with a soldering iron, the body being of 1½-in. drawn brass tube. The stroke of piston is 2 ins.

"It now occurred to me that I ought to make some provision for getting at the motion in case of necessity. I

therefore decided to put the cylinders on a separate frame. This I bolted between the main frames, and I have had reason to be thankful for this arrangement; for the repacking of glands, &c., is quite an easy matter. Having finished the working parts, I started on the boiler.



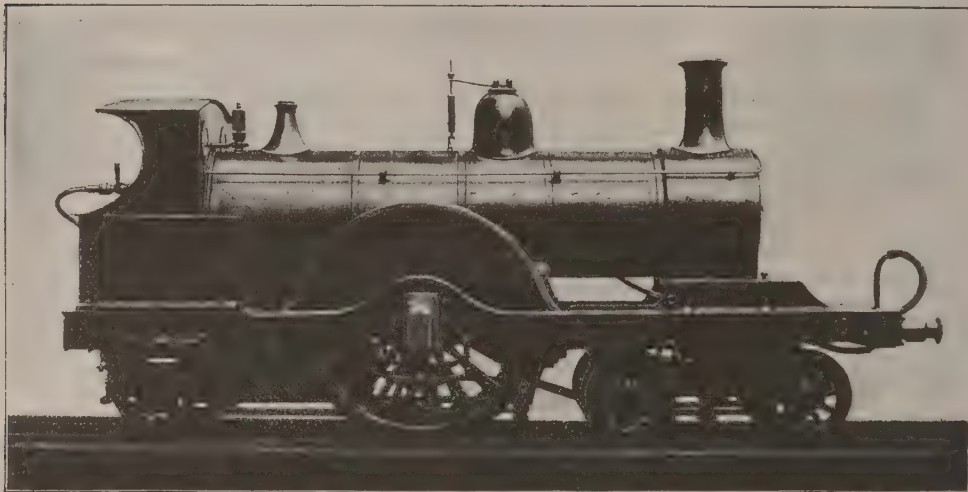
MR. WALTER ALCOCK AND HIS MIDLAND LOCO.

This I made of 1 16th in. copper, and it consists of the usual parts—boiler barrel, firebox, and firebox shell, with $\frac{3}{8}$ in. water space between the two latter. I, of course, rivetted all the joints, and made the whole steam-tight with solder. There are five tubes, $\frac{3}{4}$ in. inside diameter. When I add that on one occasion I left the blower full on by accident while I went in to tea, and the pressure went up to 60 lb., I think this part of the engine may be considered satisfactory; for nothing gave way, though I must say I never expected it would stand more than 45 lb. The dome and chimney were cast from my patterns.

"I fitted a steam brake, ring blower, pet-cocks to cylinders, and, of course, steam and water gauges. The trailing springs and bogie general spring are real, and of phosphor-bronze; while the driving-springs are only imitation, for I was afraid of the link-motion being disturbed. The firebars drop out in one piece on drawing a pin, for the sake of convenience.

The principal dimensions of Mr. Alcock's model are as follows:—

Diameter of cylinders ...	1½ ins.
Stroke of pistons ...	2 "
Diameter of driving-wheels ...	7¾ "
" " bogie " ...	3½ "
" " trailing " ...	4½ "
Wheel-base between bogie wheels ...	6 "
" " bogie centre and driving " ...	10 "
" " driving and trailing " ...	8½ "
Thickness of frame (brass) strengthened in places ...	⅛ "
Height of platform from rail ...	4¾ "
Width of platform ...	7¼ "
Diameter of boiler ...	4¾ "
Length of boiler (including firebox) ...	16 "
Heating surface of firebox ...	138 sq. ins.
" " tubes ...	137½ "
Grate area ...	18¾ "



SIDE VIEW OF MR. ALCOCK'S MODEL LOCO.

"I can get up steam from hot water in about ten minutes, the fuel being ordinary coal. I attach a bicycle pump to the clack pipe, and having lighted the wood, which is laid on the grate with the coal above it, open the blower, and work the bicycle-pump. As soon as steam is up, the pump is detached, and the steam does the rest.

"I find coal much better than charcoal, and it is more easily regulated and lasts longer, besides which it seems more real, and *smells* more correct. To be sure there is a deadly smoke until steam is up, after which there is little trouble.

"The engine has pulled along a man weighing 16 stone, with 30 lb. of steam. The lines are only 40 ft. long, but I can ride to and fro as quickly as I like, and there is generally more steam than I want.

"I am certainly blessed with kindly neighbours, for they do nothing except shut their windows when I get up steam (and smoke!), but that may be to prevent my hearing their opinion of my hobby."

Thickness of boiler plates ...	⅛ in.
Inside diameter of chimney ...	1½ "
Weight about ...	60 lb.

The Directors of the Wireless Telegraphy Company have agreed to enter into negotiations with the syndicate who desire the exclusive rights of connecting England and America by wireless telegraphy. There is every probability that the proposal will take practical form in a comparatively short time.

The early example of a steam-engine by James Watt, till recently at work in Dundee, but acquired as a memorial and example of old time engineering by public enterprise, is now about to be housed and set up in the Barrick Buildings, Dundee, where it will be in a situation well adapted to its preservation, and to free inspection of all interested. The cost of housing and erecting the engine will amount to £500, and the fitting-up will be done in such a way as to admit of electric-motor power being applied for putting it in motion if at any time desired.

The A.B.C. of Dynamo Design.

By ALFRED H. AVERY, A.Inst.E.E.

(Continued from page 25.)

CHAPTER II.

IN the preceding chapter the production of E.M.F. in a conductor moving in a magnetic field was discussed; also the fact that electric potential is developed only when the conditions are such that the conductor moves through a constantly varying magnetic field. Assuming a constant rate of motion given to the conductors, there must therefore be either a constant change in the direction of the flux, or they must move in such a manner as to cut more or less lines of force at every succeeding position; in other words, pre-supposing a uniform field, the conductors must cut the lines of force at a constantly varying angle in order to effect the necessary changes in

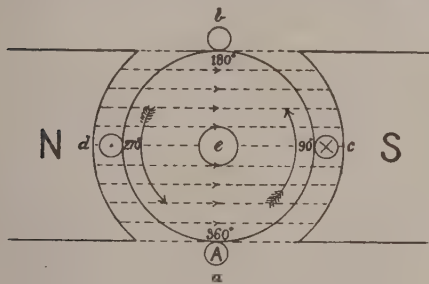


FIG. 9.

the density of the field. These conditions are complied with in Fig. 9, where a motion of rotation in a uniform field is depicted. Conductor A is shown at four different points in a complete revolution in centre *a*. At *c* and *d*, where the conductor is crossing the lines of force at right angles, and cutting the greatest number of lines per unit time, it is evident that the induced E.M.F. will be at its highest value. From these points, however, the E.M.F. will steadily decrease to its minimum value, as the angle which the conductor makes with the lines of force becomes

Applying Fleming's rule to the above case, it is seen that the induced E.M.F. in A from 0 deg. to 180 degs., and from 180 degs. to 360 degs., will be in opposite directions. Starting at 0 deg. the E.M.F. will grow to a maximum at 90 degs.; die away to 180 degs.; reverse its direction and grow again up to 270 degs.; and finally die away from that point to 360 degs., when it again reverses and repeats the cycle.

It is found that this induction follows a certain law, and varies as the "sine of the angle of rotation," when field and motion are uniform; therefore, maxima will occur at 90 degs. and 270 degs. in every revolution. By plotting out a "curve of sines" we are able to represent graphically the condition of conductor A at any point in its revolution. Let the circle A (Fig. 10) be divided into sections of, say, 10 degs. each, and a base line (B) prepared equal in length to the circumference of A, this also being divided into an equivalent number of sections. A series of heights are marked over the base line (B) corresponding to the height which that particular angle makes measured vertically from the centre line of A, and a curve is drawn through the points so marked. This wave form thus obtained is a true sine curve, and represents the instantaneous value of the E.M.F. at any point of the revolution. The curve also shows the E.M.F. induced to be alternating in direction. It could not well be otherwise, for any variation in one direction must necessarily have a limit. Every continuous current dynamo must first generate an alternating potential in its armature, which it is the function of the commutator to rectify or "commute" into one direction at the terminals.

If, instead of dealing with a single straight conductor on one side of the armature core, we give it a complete turn and bring the end back on the opposite side for the sake of symmetry, the shape of the curve of induction is in no way altered, for although the induced E.M.F. will be in contrary directions on opposite sides, the conductors being themselves 180 degs. apart, the action taking place in them coincides with that graphically shown at any two points 180 degs. apart on our sine curve. In practice, instead of a single complete turn, a coil of many turns would, as a rule, be substituted, but the only effect on the sine curve will be to augment, and not distort it.

To commute these alternations of current into one and the same direction, a "commutator" must be devised. In its simplest form this consists of a short length of tube slit at opposite sides lengthwise, and with one end of the conductor attached to each segment. Its action will be best understood by reference to Fig. 11, where *a* repre-

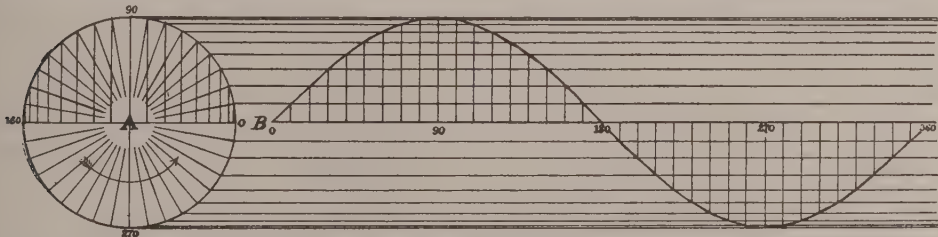


FIG. 10.

more and more obtuse; until, for an instant, at *a* and *b*, where it is travelling exactly in line with the field, it will be actually cutting no lines of force, but simply, as it were, sliding along them, and the rate of change being thus at a minimum the E.M.F. will also be practically nil.

sents the conductor, *b* the brushes for collecting the rectified current, and *c* the commutator. The commutator and brushes are so placed with respect to the conductor that at the same instant the direction of the induced E.M.F. in the conductor is reversed, the brushes cross the slits in the commutator, and so reverse the con-

nections to the brushes. Fig. 11 A shows the state of affairs a moment before reversal, and Fig. 11 B the conditions an instant later, the arrows denoting the direction of the E.M.F., and consequent flow of current through the brushes were the circuit completed.

The effect of this commutation on the E.M.F. curve is shown in Fig. 12, but there is still a great fluctuation between the base and the peak, which would render the current very unsteady; it could, in fact, hardly be called "continuous," but rather "intermittent." Some means must therefore be adopted of filling up the gaps existing between these peaks, if we are to obtain a steady current.

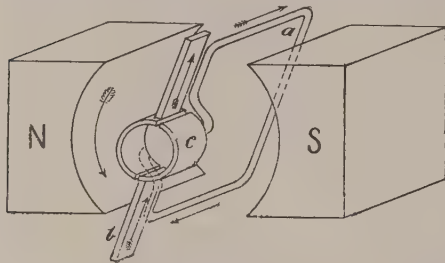


FIG. 11 (A).

To accomplish this another coil or series of coils must be added to the armature, and so arranged that when one coil is going out of action another is coming in. Fig. 13 shows the effect of adding another coil on the armature at right angles to the first. Being separated one quarter of the armature circumference, their periods of maximum activity will occur 90 degs. apart on the base line B, Fig. 10*, and we get a double series of curves, the peaks of the second set in a large measure filling up the depressions between the first. But still the current is undu-

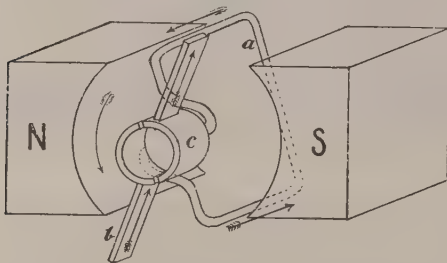


FIG. 11 (B).

latory, and to obtain greater uniformity the number of coils on the armature must be increased until the summits of the superimposed curves are so close together as to approximate a straight line. If there are so many as thirty-six coils on the armature, each 10 degs. apart, this state of affairs will be nearly realised, and the current will be practically constant (Fig. 14).

For the sake of brevity it is the custom, when dealing with the problems encountered in dynamo design, to make use of letters, or symbols, each having a certain signification; and it would be well here for the reader to familiarise himself with the following list, which will be used throughout the present series of articles. These

symbols, for the most part, correspond to those in general use at the present day:—

LIST OF SYMBOLS AND ABBREVIATIONS USED IN DYNAMO DESIGN.

E.—Volts. Total volts generated in armature.

e .—Volts available at terminals of dynamo.

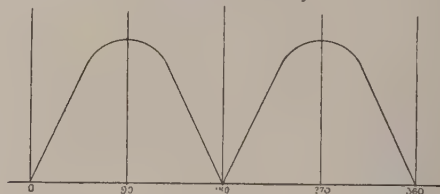


FIG. 12.

R.—Total resistance.

r_a .—Resistance of armature.

r_s .—Resistance of shunt coils.

r_m .—Resistance of main or series coils.

ω .—Ohms.

C.—Total current.

c_a .—Current flowing in armature.

c_s .—Current flowing in shunt coils.

c_m .—Current flowing in main or series coils.

l .—Length in inches.

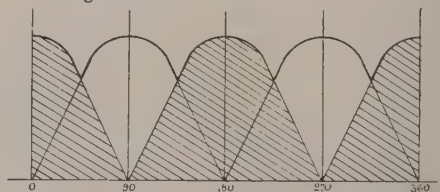


FIG. 13.

d .—Diameter in inches.

A.—Area in square inches.

t .—Time in seconds.

n .—Number of revolutions per second.

W.—Watts.

B.H.P.—Brake horse-power.

E.H.P.—Electrical horse-power.

H.—Intensity of magnetic field in air.

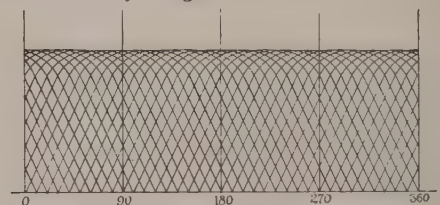


FIG. 14.

B.—Intensity of magnetic field in iron.

μ .—Magnetic permeability.

N.—Total number of lines of force in a magnetic circuit.

v .—Coefficient of magnetic leakage.

π .—3.14159; a "constant" denoting ratio between diameter and circumference of circle.

λ .—Angle of lead.

Z .—Number of conductors on armature.

* It must be remembered that this base line represents the periphery of circle A, unrolled and straightened out.

It would seem a simple matter to calculate the electromotive force generated in any armature, knowing that certain fixed relations exist between length of conductor, speed, and magnetic flux; in fact, this expression constitutes what is called the fundamental equation of all dynamos:

$$E = nZN.$$

But the dynamo designer finds it necessary to modify this simple formula, in consequence of other actions and reactions taking place in the armature and the surrounding field. The nature of these disturbing influences is too complex to deal with very fully in an elementary treatise; and it will suffice for the present purpose to point out their existence; since it can only be within the province of the expert to eliminate them to some extent by care in design.

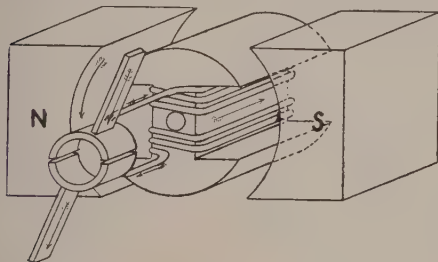


FIG. 15.

All armatures may be broadly classed into "open circuit" and "closed circuit" types. The former need not concern us much, as they are entirely unsuited for general purposes. The latter class may again be divided into (a) ring, (b) drum, and (c) disc armatures.

The shuttle or Siemens's armature, which we shall take as an example of open circuit armatures, is the one probably most familiar to amateurs, but beyond its simplicity

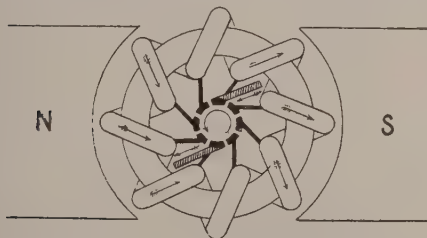


FIG. 16.

it has little to recommend it, being merely a "one coil" armature—i.e., a duplication of the single turn of conductor shown in Fig. 11, with the addition of a suitable iron core (Fig. 15), the E.M.F. it generates is subject to all the variations depicted by the rectified sine curve (Fig. 12), giving rise to much sparking at the commutator, and other losses through self-inductive effects.

The ring armature is capable of being divided into any number of sections; it has certain faults, however, which will be referred to later. The one great advantage it possesses is the simplicity of its connections, both from coil to coil, and to commutator. Thus, it lends itself well for the purpose of illustrating the nature of armature re-action, when current flows in the

conductors. To take a simple case; Fig. 16 shows an eight-section ring armature, in which the eight coils of one turn each, it will be noted, are all wound in the same direction; the finishing end of each is connected to the starting end of the next coil to it, and the junction taken to one commutator segment: it is, of course, immaterial whether each coil consists of one or many turns. The best way to regard this winding is to consider it as a single continuous or closed coil* wound round the armature,

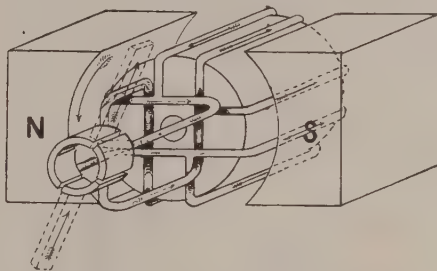


FIG. 17.

and tapped at regular intervals to convey current to the commutator. Those conductors on the inside of the ring are termed "idle wires," as being screened by the iron in the core of the armature, they cut very few lines of force, and acting simply as connectors to the active conductors, do not materially affect the value of the E.M.F.

The drum armature, of which Fig. 17 shows one of the innumerable methods of winding, differs from the ring in having its conductors wound entirely on the surface of the core, and the only idle wire is that on the ends of the armature. Its connections, though apparently more complicated, are such as to give precisely the same circulation of current as in the ring armature.

(To be continued.)

Fitting Up Carbons for Bichromate Batteries.

By F. E. P.

THOUSANDS of amateurs who use bichromate batteries—and where is the amateur who does not?—would be glad to know of a thoroughly efficient and satisfactory means of connecting up the carbons. The usual method, namely, by clamping the zinc between a pair of carbons which are connected by a copper strip, has the disadvantage that even when there is no creeping, the surface of the copper connecting strip becomes corroded in time and causes a bad contact. If the following suggestions are followed there need be no fear of the connections deteriorating when the battery is out of use, the latter being always ready at a moment's notice.

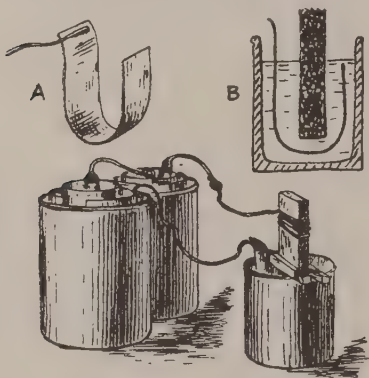
The writer has always found it best in making up bichromate batteries to clamp the elements together by bolts, one being enough when the plates are about 1½ ins. wide, and two when they are about 3 ins. wide. The holes in zinc should be at least ⅓ in. bigger than diameter of bolt, a little tube of many turns of waxed paper separating the bolt and the zinc plate. Bolts ½ in. diameter are suitable, and with two carbon plates ⅜ in. thick, zinc ⅓ in. thick, and wooden strips 3-16ths in. thick, the bolts should be 1½ ins. long. Black bolts

Hence the term "closed coil" armature.

and ruts of these dimensions can be bought for about 1s. 3d. per dozen.

Having drilled the necessary holes in the carbon plates about $\frac{1}{2}$ in. from the top, proceed as follows:—Melt paraffin wax in a gallipot by placing the latter in a saucepan of water kept just simmering. Let the wax stand about $1\frac{1}{4}$ ins. deep in the pot. Now stand two carbons in the wax, tops downwards, keeping them clear of one another and away from the sides, or capillary action will take place, and the wax run too far along the carbons. They should stand for a quarter of an hour or so, being then drained and put aside, and the next pair immersed. Fresh wax will, of course, be required to make up for that absorbed by the plates.

When all are done, make up a simple Daniell battery of two cells, using jam pots, thin copper plates, and Leclanché zincs. A depositing cell will be further needed, and this may consist of a gallipot, which must be nearly full of saturated solution of sulphate of copper.



The waxed top ends of carbon plates are to be copper-plated, and this will be effected by placing the carbon top end downwards in the solution of sulphate of copper, allowing about $1\frac{1}{4}$ ins. to be immersed. A copper plate about 1-16th in. thick must now be bent to the form shown in the sketch at A, the width being about two inches. This copper plate must then be arranged in the depositing cell, as shown diagrammatically at B, care being taken that the copper plate does not touch the immersed carbon at any point. A piece of No. 18 or 20 copper wire may be soldered to the copper plate for connection, and a similar wire connected to carbon by wrapping tightly round it half-a-dozen turns. Connect the carbon with the zinc terminal of the Daniell battery, the cells of which are connected in series. The copper plate must be connected to the copper terminal, and the action will then at once commence. The whole arrangement is clearly shown in the accompanying sketch.

The length of time taken to deposit a fairly thick coating of copper on the carbon may be anything between three and eight hours. When sufficient copper has been deposited to make a firm and substantial joint, a second carbon may be substituted for the first, which may be washed and dried, and it will then be found an easy matter to solder a piece of No. 18 copper wire to the top and so make a connection which will be at once durable and efficient. The trouble of this method will be well repaid in the reliability and permanence of the battery when made up.

How to Make a Cheap Reliable Galvanometer with Bridge and Scale.

By A. S. WEISS.

THE galvanometer shown herewith (Fig. 2) is a first-class instrument, for use with a Wheatstone bridge, for measuring resistances of wires for field and armature coils. It is classed as a low-resistance, reflecting, astatic galvanometer, and is easily constructed by amateur electricians, the advantages gained by its use repaying the maker for the trouble taken in its construction. The scale card is cut from paper, being a circle 3 ins. in diameter, divided into spaces of 3° each. The two zero points are opposite, and run up to 90° , each five spaces being marked $15^\circ-30^\circ-45^\circ-60^\circ-75^\circ-90^\circ$. The two points marked 90° being opposite.

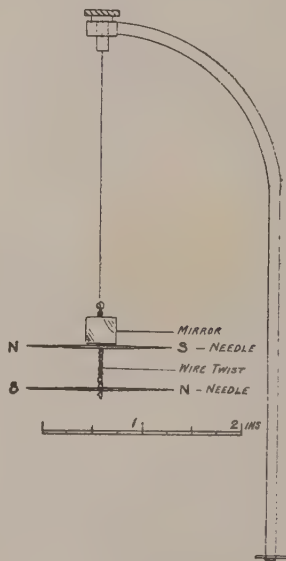


FIG. 1.

1. A base is made of wood—cherry will do very well. This is best turned on a lathe, and a slot turned into it for the reception of the glass shade. It can be polished by running the lathe at a high speed, holding a rag saturated with shellac varnish to it. The necessary holes (two for wires, two for binding-posts, and one for standard) should be drilled preparatory to polishing.

2. The coil (Fig. 3) is wound same as shown—best done on a wooden form one part at a time—both parts together having a resistance of $\frac{1}{2}$ ohm. After winding, a tie wire should be fastened at each end of each part, to hold wires together. The two outside wires are joined, put through hole in cherry base made for their reception, and turned over, partially keeping coil in place; the two inside wires are run through other holes, and one run to each binding post, as shown.

3. The standard (Fig. 1) is made of brass, bent as shown and rivetted to cherry base. A hole is drilled through its head for the reception of a brass swivel to hold system.

4. The system is made by taking two sewing needles and inserting them in the twists of two copper wires, as shown, and fastened by a drop of solder, using sal ammoniac as a flux. The twisted wire ends in a loop through which a single silk fibre passes and runs up to swivel where it is fastened with a drop of sealing-wax. A small square of mirror glass is fastened to copper twist over top needle by sealing-wax, as shown. Measurements can be taken direct from blueprint.

5. The coil is mounted and a small brass plate is placed inside of it, so as to engage each part of coil, and

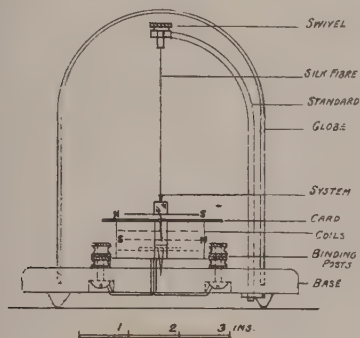


FIG. 2.

than a metre and 4 ins. wide. A German silver wire is placed between two binding posts AB, 1 metre apart and a scale marked under it of 100 centimetres. Then binding posts CDE are inserted and connected on bottom side by a bare copper wire. This completes the bridge. It is used as follows:—

The terminals from a battery are inserted at binding posts, AB. A known resistance, say 50 ohms, is connected to EB, the unknown resistance to AC, one galvanometer terminal to D, the other one slid along German silver wire until needles cease to move and come to zero. Say the scale indicates at F on board 40, then we get the proportion:

50 = known resistance.

x = unknown resistance.

40 = one side of bridge.

100 - 40 = 60 = other side of bridge.

$$x : 50 :: 40 : 60 = \frac{2000}{60} = 33\frac{1}{3} \text{ ohms} = \text{unknown resistance.}$$

SCALE.

This is used in delicate tests, and is made of a strip of wood $\frac{1}{4}$ in. thick, 24 ins. long, mounted as shown, and a

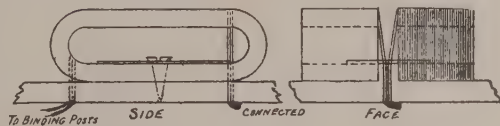


FIG. 3.

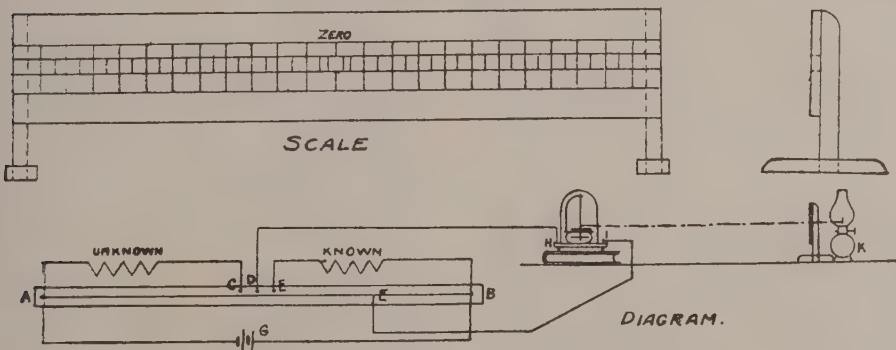
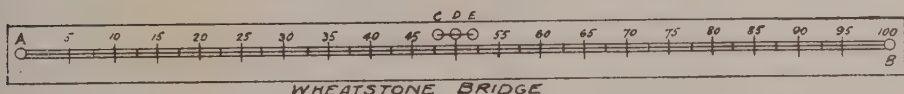


FIG. 4.

screwed to base with a brass screw. The cord is drawn and cut, and fastened to top of coil by sealing-wax. The needles of the system are magnetised to a polarity, as shown, by holding a magnet leg on one end of top needle for twenty minutes; then hold other leg of magnet on same end of lower needle for twenty minutes. The system is now hung and glass shade placed in position, completing galvanometer.

The bridge is used in connection with galvanometer; it is known as the Wheatstone slide metre bridge. As shown in (Fig. 4), it consists of a $\frac{1}{2}$ in. board 4 ins. longer

1-in. scale marked on each side of a hole made in middle of board $\frac{3}{8}$ in. $\times$ $\frac{1}{4}$ in. This hole is also cut in a piece of tin, and fastened over aperture in wood to give sharpness to the beam of light transmitted by lamp to galvanometer mirror back to 1-in. scale on faceboard. The lamp is placed in back of scale, so that lamp flame, hole in scale, and mirror in galvanometer are in line. Then when galvanometer is a zero beam of light, invisible as it falls on the aperture in scale. The least amount of current which unbalances the current causes beam of light to move up or down on the 1-in.

scale, although no perceptible move is apparent in system. In a test, connect as shown, and move galvanometer terminal slowly up and down German silver wire on bridge until a perfect balance is brought about, which is made apparent by beam of light falling on hole in scale. Then readings are taken, and the result ascertained by the aforementioned proportion.

This is an invaluable instrument to the amateur, and well worth his best care and intelligence in construction. To these I extend my best wishes.

[Complete sets of parts for making this instrument are supplied by the Stirling Electric Co., Stirling, New Jersey, U.S.A.]

Electrotyping for Amateurs.

By A. P. DRAKE.

(Concluded from page 50.)

THE solutions used are the double cyanides of potassium of either gold or silver. The most simple way of preparing the baths is as follows:—Procure two Daniell cells, and an enamelled iron saucepan which will hold a pint of liquid. In a quart of filtered rain-water dissolve 2 ozs. of best potassium cyanide. We shall also require two silver plates, $2\frac{1}{2}$ in. by $1\frac{1}{4}$ in., and about $\frac{1}{8}$ in. thick, and drill a small hole in the middle of one, short side, large enough to hook in a slinging wire. The silver plates must be perfectly *pure*.

Put a pint of the cyanide solution into the pan, and suspend the plates on opposite sides from two pieces of wood. The plates must not touch each other or the pan. Then connect the wire slinging hooks to the two Daniell cells connected in series, and allow the current to pass from one plate to the other for about two hours. Then take off the plate connected to the zinc end and replace it with a clean brass one. If this plate takes a coat of silver the solution is ready for use. When the silver solution is ready for use it should be poured into a clean glass bottle and labelled "Silver solution—Poison." The gold solution is prepared in a similar way from the remaining pint of solution, only use small strips of pure gold instead of pure silver. Before preparing this solution the pan must be well washed out. The gold solution must be kept at a temperature between 160° F. and 180° F., or scalding hot during this and the plating process.

As the rule for plating is that the "anode" should present a surface slightly over that of the object to be plated, the two gold plates will have to be connected together on the same side of the bath whilst the plating process is proceeding. When the solutions and apparatus are not in use they should be kept in a locked cupboard, owing to the poisonous nature of the materials used. The electrotype must now be polished where it is intended to be plated, and cleaned by brushing with whitening moistened with pearlsh water. The parts not to be plated must be varnished with thin shellac or copal varnish.

The electrotype having been well rinsed in warm water to get rid of any whitening, and the varnish dried, suspend it in the solution with a slinging wire. A single Daniell cell will deposit silver or gold from these solutions, and may be made by inserting a copper plate, bent to fit the jar, in the place of the electrotype in the copper sulphate solution. The copper plate may have a binding screw soldered to it, or may be connected with a piece of the thick wire to the triangle. In plating, the zinc must *always* be connected to the article to be plated, and the copper plate to the anode. With a large electrotype, two

cells may be required, but always do as in electrotyping, put on the first coating slowly, and afterwards proceed more rapidly by adding the extra cell. If too much current is used the metal is deposited roughly and in small lumps, which have to be smoothed down with a brush made of fine brass wires called a scratch brush.

If the electrotype is only intended for show, a thin deposit only is necessary; but if wearing qualities have to be considered, the action must be continued two or three hours. It will then be covered with a creamy-white deposit, if silver, which is slightly rough. Remove the article from the bath and well wash it in warm water, and brush down all the rough places. This will give it a polished appearance if done whilst wet. After drying in bran or boxwood sawdust, the surface will appear dull, but will feel smooth to the touch. A little further treatment with the brush will add a slight polish, which is all that can be done with ferns and other open leaves.

If gold is deposited on copper, the coating will have a dull 15-carat tint, so that it is usual to first give the object a thin coat of silver, well wash it, and then transfer to the gold solution. A durable coat can be obtained in fifteen or twenty minutes with a hot gold solution. For those readers who intend to take up this subject as a means of increasing their income, and thus needing a larger plant than the one described, I here give the proper plating solutions:

Gold.—Dissolve 1 oz. of potassium cyanide in 1.1 pints of water, and add gold chloride in proportion to the amount to be used. This will, of course, depend on the size of the object or objects to be plated. If the bath is acid, it must be made alkaline with ammonia. It may be used cold, but used hot the colour is improved and the coat is more durable.

Silver.—This bath is prepared from 2 lb. of potassium cyanide, 14.23 pints of water, and 2.4 ozs. of carbon disulphide. The object of adding the carbon disulphide is to make the objects come from the bath with a bright surface, rendering polishing unnecessary, and thus producing cheaper articles.

Since writing the above, I have received, in my capacity of model engineer expert, an inquiry as to the method of making the letters so often seen on brooches in jewellers' shops. The letters are made in dies specially made for each work, and a large number are struck off every time the dies are placed in the "press," as the machine is called. These words, or it may be sentences, or even the whole brooch with a motto or text in raised letters on its face, are made at one blow and sent off to the platers, and are then returned wrapped in tissue paper, in which wrapping they are stored until required. This is the method by which these things are made in a wholesale way, and is not suitable for an amateur worker at all.

He will have to proceed in a rather more round-about way, and also take more time over the job. Procure an alphabet—that is, A to Z—of type from a printer, the letters of the size required for the work in hand. If so disposed, the worker could invest in, say, three complete sets of type, and then could set up a word at once in his trays. Then pack them up with the fine sand, so that the letters are just above the surface. A plaster mould can now be taken in the usual way, and afterwards electrotyped as before described. The type can be bought for about 1s. 6d. or 2s. per lb., and does not weigh very heavy.

Pretty effects can be obtained by neatly soldering a name to a small fern, and then mounting the whole on a back plate to form a brooch.

Should any reader be confronted with any difficulties in connection with this subject, I shall be pleased to do my best to set him on the right track.

Model Yachting Supplement.

To Our Model Yachting Readers.

IN introducing to our readers this MODEL YACHTING SUPPLEMENT, we are making an experiment, the success of which depends almost entirely on the way in which our efforts are supported by those for whom we are endeavouring to cater in this section of our journal. It is emphatically a case in which our yachting readers, by helping us, can help themselves. We look to those readers who wish to see this supplement an established feature of the journal to help us by sending in regular reports of the doings and races of their clubs, detailed particulars of new boats which they may be building, or which may come under their notice, suggestions for designs, and also criticisms, comments, and correspondence on all matters of interest to model yachtsmen. We believe we are right in saying that there is at present no journal in existence which deals specially with the doings of the model yachting world, and which provides space for the full and free discussion of the many debatable points in connection with the designing, building, and sailing of model craft. In this supplement it is our aim to provide such a medium, and, if our project meets with a sufficient measure of appreciation and support, we intend to make it a regular feature of THE MODEL ENGINEER. The present issue must by no means be taken as a sample of what we think it possible to do; indeed, we are only too well aware of the many ways in which it falls short of what a model yachting journal should be. We have had many difficulties to contend with in the collection of club news and racing reports, much of the matter only coming in at the very last moment before closing for press. In some cases, too, contributors upon whom we have relied have been obliged to disappoint us through ill-health or other unforeseen circumstances. Model yachtsmen have, moreover, been so long without a representative paper of their own—for it is some years since Mr. T. A. Bruce, of *Model Yachtsman* fame, laid down his able pen—that many secretaries have forgotten the necessity of writing out reports for publication, club members have forgotten that there are other clubs in existence besides their own, and the faculties of individual yachtsmen for designing, criticism, and controversy are lying dormant for sheer want of a journalistic arena wherein they can pit their strength one against the other. With the advent of our MODEL YACHTING SUPPLEMENT we hope to change all that, and we shall welcome any amount of suitable matter for publication, whether it be in the shape of club reports, original articles, or designs, or correspondence; in fact, this is to be the paper for model yachtsmen—we want

them to make use of it. There is one other direction in which our readers can help us—that is, by telling their model yachting friends what we are doing. The more model yachting readers we get, the more we shall be encouraged to improve and increase the matter we provide in these pages. With these few words by way of introduction, we leave our first supplement to make its bow to the world of model yachtsmen, and we hope that we shall receive sufficient response to our efforts to enable us to bring next month's pages considerably nearer to the ideal we have in view.

Doings of the Clubs.

[The Editor will be glad if club members will keep him posted up in the latest items of news suitable for this column.]

WE hear that a model yachting club has just been formed on board H.M.S. *Curaçoa*, with Mr. W. F. Bebenna as its moving spirit. At present the "fleet" only consists of two 10-raters and two 5-raters (L. & S.A.—Y.R.A. 6000 rule), but another 5-rater is framed up, a 10 rater has reached the paper stage, and a 20-rater is projected. The members intend sailing over triangular open water courses, wherever the ship may be at anchor. The *Curaçoa* will be at Queens-town at end of April, Moville early in May, Campbelltown end of May and early in June, Ilfracombe to June 12th, and then Plymouth to middle of July. When at Plymouth occasional races will be arranged with the Port of Plymouth Club, the members of the *Curaçoa* Club also belonging to the latter body, and having adopted their rules and measurements in their entirety. Yachting readers in any of the ports above mentioned can, by writing to Mr. Bebenna, arrange the preliminaries for matches to be sailed on the vessel's arrival.

* * *

Since its formation in 1893 the Tynemouth Model Yacht Club has made considerable progress. The headquarters are at the Tynemouth Park lake, and the models are divided into 5, 10, and 15-ton classes, and a 15-rating class. The 15-rating models must not measure over 15 tons (1730 rule). The tonnage goes by the 1730 rule, and the rating by the Y.R.A. rule. The secretary, Mr. H. Sharp, writes as follows:—"The type of boat we think best all round is the long narrow boat, the hull having about 4 ins. draft of water, and carrying 12 lb. (10 tons), or 15 lb. (15 tons) lead kept suspended in a bulb on two fins. This class we find do well in 15-rating, against the short broad beam boat measuring from 25 to 30 tons, although they may be thought crippled for want of sail. We have also the same type of boat with one large fin, carrying a bulb in centre with small fin aft. All our races are sailed on the tournament system, and, whenever possible, a dead beat to windward. During this season we have sailed three club races, with the following results: March 11th—10-ton race, 10 starters: J. Stewart's *Maud*, 8 wins, first; C. Addison's *Genesta*, 7 wins, second; T. Graham's *Falcon*, 7 wins, third. March 3rd—

5-tons race, 7 starters: J. Stewart's *Tib*, 6 wins (a new yacht; her first race; beat all her opponents), first; W. Sharp's *Pelitz*, 5 wins, second; C. Addison's *Zephyr*, 4 wins, third. April 8th—10-ton race, 10 starters: J. Stewart's *Maud*, 8 wins, first; T. Graham's *Falcon*, 8 wins, second; H. Sharp's *Breeze*, 7 wins, third. We also competed in the inter-club race for the silver cup presented by Mr. J. N. Alexander. In this race our Tynemouth models were beaten by the newer yachts of Newcastle and Jarrow Clubs. Of our yachts, the *Maud*, in her third season, scored 14 wins; *Nymph*, fourth season, 13 wins; *Terror*, fourth season, 10 wins; *Breeze*, fifth season, 8 wins. Some new 10-ton models in our club would, undoubtedly, do us some good for inter-club races, and as our members are energetic and enthusiastic, we may soon expect to have a good fleet launched."

Mr. S. B. Cozens, the hon sec. of the Swansea Model Yacht Club, writes:—"Our annual cup match with the Cardiff Club is by far the most important event in the year's racing. Last year our club were the holders of the cup, I having won it with *Lady of the Lake*. Nearly all our boats are of the double-fin type, experience having taught us that they do not get hit so much to leeward as a keel boat does when going to windward with a big sea running. Our season comprises all the winter months, commencing in October and ending in April, so that we have to contend with some very stiff blows. The only restriction is that no boat must exceed 4 ft. LWL, and under this rule a very healthy type of boat has been developed; the only fault is a tendency towards excessive beam, to increase sail-carrying capabilities. Our most successful boats are 13 ins. beam to 44 ins. LWL, and about 66 ins. over all, drawing about 12 ins. of water. In racing, a time allowance of 30 secs. per inch LWL per mile is given."

Mr. G. F. Watson kindly sends us the following particulars of the Port of Plymouth Model Yacht Club:—"Our chief event is the racing for the West of England Model Yacht Challenge Cup, held annually on Whit Monday, and to be sailed for this year at Plymouth. Last year it was sailed for at Fowey, and next year it will be contested for in Brixham, the Plymouth, Fowey, and Brixham Clubs being affiliated. The model yacht clubs in adjacent ports are manifesting a disposition to work with us. We have also a series of matches for 10-raters

and 5-raters, all measured as follows:—
$$\frac{\text{LWL} \times \text{SA}}{6000} = \text{all in inches.}$$
At all the ports interested, the races are necessarily held in the sea, there being no ponds available, and this involves attendant boats and crews."

The Edinburgh and Leith Model Yacht Club held its annual general meeting in the usual hall, High Street, in March last, the treasurer in the chair. The treasurer's report showed the club to be in a very healthy condition. Officials were elected as follows:—President, Mr. J. McLennan; secretary, Mr. A. Flockhart; treasurers, Mr. J. T. Nicolson, Mr. F. Ker.; committee, Messrs. G. R. Hamilton, Millar, Marshall, and Veitch. The fixtures for the season were submitted and approved and the rules revised. At this meeting a small cup was presented by one of the members, Mr. Simpson, to be competed for by Class I. At a subsequent meeting Mr. R. Porteous was appointed commodore in the room of Mr. G. R. Hamilton, whose resignation on account of ill-health the members of the club very much regret. Mr. Hamilton being a keen yachtsman and a general favourite, we hope to hear of his speedy recovery.

How to Build a Model 10-Rater Cutter Yacht.

By GEO. R. SCOTT.

THE instructions for building a model yacht in an article of this kind must, of necessity, be very much curtailed.

The Hull.—The best wood is yellow pine or willow, or any straight-grained light wood, free from large knots and well seasoned. The solid block is the simplest and best for an amateur; but another easy way is in halves, screwed together from stem, round keel to stern. In this way it is much easier to hollow out the hull and to make true by the use of templates.

The most popular size in all yacht clubs is what is termed a 10-rater—that is, a boat 40 ins. on the water line—and to ensure being able to enter the vessel in a racing competition, it is requisite that a boat about that size should be made carrying about 1,500 sq. ins. of sail; for one much less is now considered too much of a toy for young men.

The plans are those of a racing 10 rater, 40 ins. on the water line, and 58 ins. over all, but the builder can make a boat half the size (29 ins.), or one 43½ ins., from the same scale.

The deck should be yellow pine, straight grained, clean and free from knots, and 3-16ths in. thick, strengthened at mast and four other spaces with cross beams, having about ¼ in. rise in centre so that the deck when finished has a slight round. It is scored for imitation planking, ¼ in. apart, with a drawpoint or awl, and varnished on both sides. It is then cemented on to the top of the boat, and screwed down every 2½ ins. with ¾-in. brass screws. There are no ornamental fittings, such as cabins, &c., on racing yachts, as they only tend to impede her progress. The helm post comes up through the stern in a ⅜-in. tube, and care must be taken that it is watertight at top and bottom.

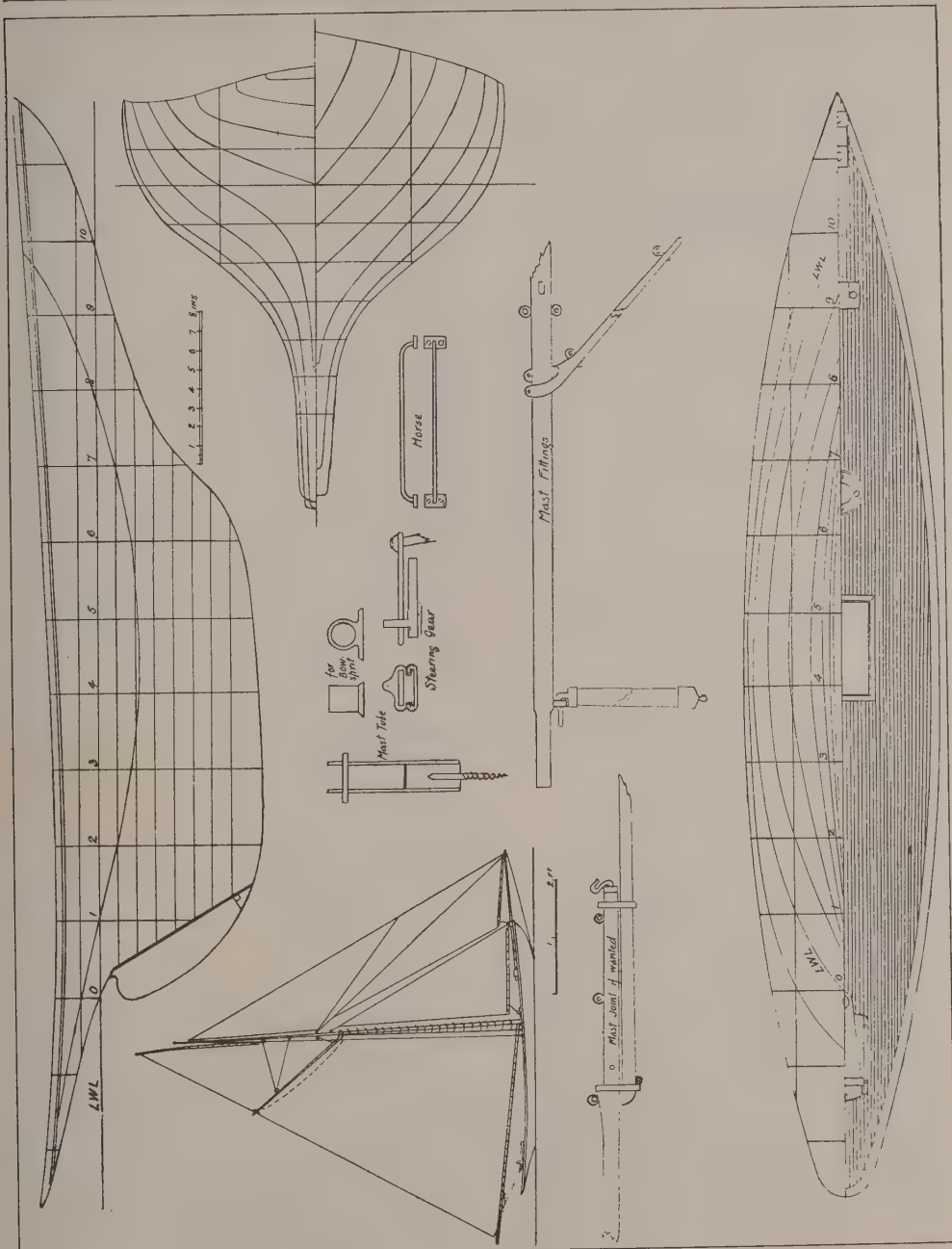
The mast is made to come out when the stays on each side are unhooked, taking the mainsail with it, which is held to the mast with sixteen light brass rings, but the head and foot of sail are laced to gaff and boom. The bowsprit can be adjusted to any length by a pin passing through it at the bits, and it should also come out.

The foresail, jib, and gaff top sail are all hooked on to the spars.

The sails should be fitted very carefully, and made of model sail cloth, as on them depends very materially the speed of the boat; fine cord should be run through the hems of all the sails and made fast at the corners.

The weight of the **lead keel** is found by loading the boat with bits of lead, or stones, enough to bring her down to the water line. This is done previous to screwing on the deck, the weight of the deck, mast, spars, and sails being subtracted from it, and the lead cast to that weight. The keel can be tested by tying it to its place with string; when satisfied as to its being correct, fit it on.

The painting should not be done in a hurry, as it ought to get three or four coats of paint, being well ground down with water and pumice stone, and allowed to dry thoroughly between each coat. After being polished it should get two coats of copal varnish, and will then be as smooth as glass. Colour, from keel to water line, scarlet, copper, bronze, or carmine; from water line upwards, bright blue, with a gold band ¼ in. wide, about ⅜ in. from deck. I would suggest to give the painting to a coach or good house painter, who would make a better job, price about 5s. to 7s. Do not forget to give the spars, &c., two coats of varnish at the same time.



DRAWINGS OF MODEL 10-KATER CUTTER.
(For description, see opposite page.)

The Tenby Model Yacht Club.

WE are indebted to the hon. sec., Mr. F. G. Hughes, for the following particulars of the Tenby Club:

"This club was formed in August, 1895. The racing ground is Tenby Bay; the course is half-a-mile dead run to leeward, and half a-mile beat back to windward, twice round, and the average time our boats take to do the whole course is 70 minutes. The size of our boats vary from 30 in. water-line to 72 in. LWL; but we find the large boats very clumsy for salt-water sailing, our most useful boats ranging from 40 in. to 50 in. LWL. We steer our boats by trimming their sails, but we use lead-running rudders to ensure a dead run to leeward. Our best boats are boats with plenty of bottom and deep keels, pole masts, all our halliards working with toggles. We find deck fittings a very great hindrance to salt-water sailing. Our sail-maker is Mr. John Nicholls, Trafalgar Road. He is a tailor, and has made the sails for the most successful boats in both the Tenby and Swansea Model Yacht Clubs. Last season was a rather unsuccessful one for us, as Tenby, though a very beautiful place, is very much neglected by visitors, and the club depends mostly on public support. Mr. R. Jones' *King Ja Ja* won twice in succession a valuable time-piece; she also held a silver cup, which was taken from her, and finally won by Mr. W. Noble's *Ilex*, a new creation. The *Ilex* also holds a silver cup, which she won once, but the final race had to be postponed owing to bad weather. It is to come off on Whit-Monday next. We have also fixtures every Saturday afternoon during August and September, when substantial money prizes will be offered. Our two most successful models, the *Ilex* and the *King Ja Ja*, visited Swansea Royal Regatta, and took first and second prize respectively."

LIST OF OFFICERS.

Presidents—Clement J. Williams, Esq.; H. de Winton, Esq.

Commodore—E. M. R. Bryant, Esq.

Captain—George Bowen.

Treasurer—J. Hughes. *Secretary*—F. G. Hughes.

GENERAL RULES.

1. *Name of Club*.—This club shall be called "The Tenby Model Yacht Club," and its object shall be to encourage designing, building and sailing of model yachts.

2. *Station*.—The station shall be Tenby Bay, or elsewhere as the members in meeting shall decide.

3. *Club Flag*.—The club flag shall be white square, 2 ins. x 1½ ins. with red vertical bars, and letters T.M.Y.C. in black upon it; and no yacht shall compete in any race unless the club flag is carried on the yacht, or otherwise be fined sixpence.

4. *Election of Members*.—Anyone wishing to become a member must be proposed by two members, who may be present at any meeting, and in all cases there must be a majority in their favour, and when admitted must pay an entrance-fee of one shilling, and a subscription of sixpence per month, payable in advance, either monthly, quarterly, or yearly; five members to form a quorum.

5. *Arrears*.—Previous to the start of any club race, the secretary must supply the officer of the day with a list of those members who are in arrears with their subscriptions, and such members to be disqualified from sailing in that race.

6. *Resignation of Members*.—Members wishing to withdraw from the club must give a month's written notice to the secretary; should they fail to do so, they

shall be liable to pay their subscription for the ensuing month.

7. *Meetings*.—The secretary shall call a general meeting of the club when requested to do so by the committee, or on receipt of requisition signed by five members, and each member shall receive a day's notice before any general meeting.

8. *Secretary's Duties*.—The secretary shall keep correct minutes of the proceedings of the club, in books which are to be produced at every meeting. The secretary shall also keep a list of yachts owned by members of the club which have ever been entered in a club match, and any owner disposing of his yacht shall notify the same to the secretary.

9. *Entries*.—Members may be allowed to enter any number of yachts in a club race, and all yachts to be entered one day before the race. No entry of a yacht will be received from anyone but the owner.

10. *Club Funds*.—The funds of the club shall be used for prizes and other purposes as directed by the committee, and sanctioned by the club.

11. The club shall not be dissolved as long as there are three contributing members.

SAILING RULES.

1. All races and boats sailing shall be under the direction of the officer of the day.

2. *Measurement*.—The yachts shall be measured length on water line, and their name and size must be registered in the minute book of the club. Each boat to have her name plainly painted or engraved upon her.

3. *Time Allowance*.—All yachts shall be handicapped on a time allowance of thirty seconds per inch for the first mile, and fifteen seconds for each subsequent mile.

4. *Sailing over the Course*.—No member shall be allowed to sail over the course for purpose of practice after racing has commenced, and any member infringing this rule shall be liable to a penalty of 2s. 6d.

5. *Handling Yachts*.—Any yacht touched during race to have her booms shifted to opposite side, except when a boat is coming in on the winning line, the sailor be allowed to trim the sheets once; in the event of the boat being the wrong side of the mark then he be allowed to trim the sheet again, but the boat must have run her distance and crossed the line before trimming her sheets a second or third time.

6. *Protests*.—All protests to be made verbally during or immediately after a race to the officer of the day, and also in writing to the secretary, within twenty-four hours of the race, stating grievance, or no notice will be taken of it; a deposit of 2s. 6d. to be made, returnable if not considered frivolous.

7. *Fouling*.—Any yachts fouling one another during race may be cleared, but not taken out of the water.

8. *Obstructions*.—In the event of yacht being fouled by an obstruction so near the winning mark, that in the opinion of the officer of the day she would have won, she may be declared the winner.

9. *Crew*.—One man only shall be allowed to sail a yacht, but he shall be entitled to one assistant for the purpose of holding on, and also dealing with rudder.

10. All oars to be out of the water when boat is touched.

11. No sculling to be allowed.

12. No attendance boat shall be allowed within ten yards directly ahead of a model.

13. In beating to windward, if a yacht should be fetching to windward of her mark it shall be lawful to use running rudder, without shifting booms to the opposite side.

Boiler for a Model Steam Pinnacle.

By E. C. WEBSTER.

SOME while ago I desired to make for a special purpose a small model of a man-o'-war's steam pinnacle, and as the hull was only to be 24 ins. in length, I met with difficulties with regard to the boiler.

The matter would have been easy enough, had I only to make a boiler large enough to drive the engine at the pace I required, without any reference to size or shape; but the boiler had to be in proportion to the rest of the craft and here was the difficulty, and I cannot help thinking that my experience with the little boat may be of use to the young amateur whose pocket is not too full.

It must be remembered that a pinnacle is an open boat, and that there is no deck to hide a flat topped boiler. The boiler must be circular, and to be externally correct the funnel must spring from an extended smokebox, without passing through the boiler or steam dome.

I found, on looking into the matter, that I was confined to the following measurements and that even these were,

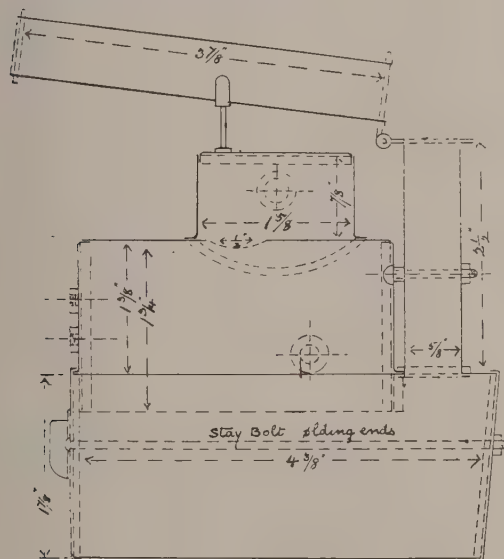


FIG. 1.

strictly speaking, too large, viz.: diameter of boiler, $3\frac{3}{8}$ ins.; length of water space, $3\frac{3}{4}$ ins.; length from front of boiler to rear of smokebox, $4\frac{1}{2}$ ins.; height of steam dome, $\frac{5}{8}$ in.; diameter of same, $1\frac{1}{2}$ in.; diameter of funnel, $\frac{5}{8}$ in.

Now, the difficulty was to squeeze into this space sufficient water to run the engine for a decent period, and at the same time to provide enough heating surface to be effective for the speed required.

I made three boilers with elaborate tubular systems, but they were too long in raising steam. I found out one point, which may be very well known, that there is a level for water in a boiler which gives better results than any other level. In other words, there may be too much or

too little water. The only way to keep this level as constant as possible is to use a hand-feed pump, a pump on the engine being too fidgety on such a scale.

Altogether, I made eight boilers, and the last was the simplest, and gave the results I required. I append a photograph of the finished boiler (fig. 4), longitudinal and a vertical section (Figs. 1 and 2), also a sketch of the lamp (Fig. 3); and it all looks a very simple

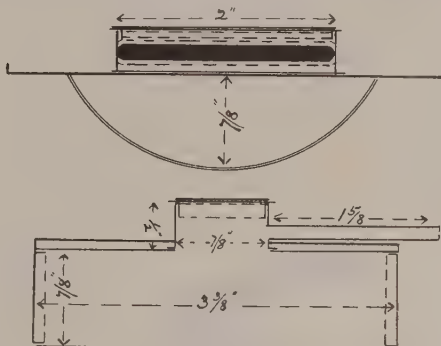


FIG. 3.

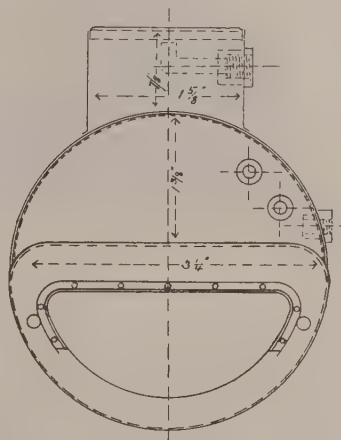


FIG. 2.

affair, and very like the usual sort of plain boiler; but the principle is quite different in working from what I have seen of simple boilers of the kind as sold.

It will be noticed that the wick of spirit lamp (Fig. 3) is flat and 2 ins. wide; this is large for the size of firebox, and the funnel is small in diameter for the size of flame, and, if made in the usual way, the boiler would have been heated chiefly outside, as the flame would never have followed the flue. The reason for its doing so without the assistance of any exhaust up the funnel is that the lower part of the firebox front is closed to cold air by the spirit lamp fitting close against it, this leaves a narrow slit above the wick *only* for the air to go in at; it therefore beats against the whole breadth of flame, driving

it at once in a thin sheet along the bottom of water space and makes steam from cold water in three minutes by the clock. The advantages of this boiler, and the use of a hand-feed pump in boats up to 3 ft. in length, seem to me to be the following:—Small size of boiler and small quantity of water, therefore less weight; and if boat is properly constructed, no ballast on the boiler's account; as constant level of water as possible, if one or two strokes are given to pump every time boat comes in; no unget-at-able seams to leak if boiler goes dry; no projecting parts above gunwhale (the top of dome in mine comes on level with gunwhale); no screw filler to aim at in filling boiler, and no leakage from the same.

The exhaust from engine is led outside the boat along-side the keel for about 4 ins., through a tube made of thin copper, the other end of which projects into the hull about $\frac{1}{2}$ in. between the engine and boiler, and the suction from pump draws from the same level; the boiler is,

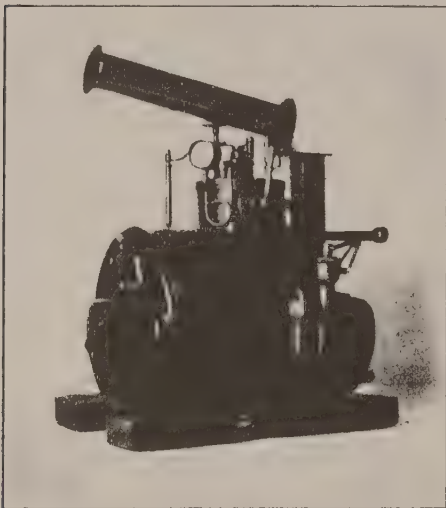


FIG. 4.—PHOTOGRAPH OF FINISHED BOILER.

therefore, replenished with warm water instead of cold. It is filled to start with, if found empty, by pouring a little water into the boat and then using the pump.

As hand-feed pumps are not generally made on so small a scale, the ordinary engine pump, minus the eccentric, and fitted with a hand gear, fulfils the purpose, and should be fastened to the side of boiler by a screw union, which, if strong, will be found efficient.

My boiler is lagged over the water space with sheet-iron, shaped to fit and fastened down with brass bands, a layer of flannel interposing.

The lower-priced models are not, as a rule, fitted with a lubricator in the cylinder cover; a screw plug, fitted for the purpose of oiling the piston, makes a great difference in the speed of the engine.

GUERNSEY M.Y.C.—The adjourned meeting of the Guernsey M.Y.C. took place on Monday, April 10th, at the Constable's Office, at 8 p.m., Major Bernard presiding. The business included the election of the various officers for the ensuing season, the discussion of rules and other matters relating to the pastime.

Racing Reports.

[Secretaries are invited to furnish the Editor with regular reports of their Club races, for free insertion under this heading. The value of these reports to other readers will be greatly increased if some detailed particulars as to design and measurements of the winning boats are given.]

Swansea.—On Good Friday the Swansea Model Yacht Club sailed two races at Kenfig, for special prizes presented by Sir J. T. D. Llewelyn, Bart., M.P. (president of the club), and Mr. R. E. Harris (vice-president). The course was four breadths of the pool, two to windward and two to leeward. A fresh breeze from the S.W. prevailed, and some very fine sailing was witnessed. The entries were:—*Rosemary* (Mr. W. J. Cozens), *Diamond* (Mr. T. Fox), *Lady of the Lake* (Mr. S. B. Cozens), *Granville* (Mr. W. Thomas), and *Valkyrie III.* (Mr. J. Barclay). The last named was an easy winner, *Diamond* being second, and *Lady of the Lake* third. The entries for the second race were the same as for the first, and resulted: 1st prize, *Lady of the Lake*; 2nd prize, *Valkyrie III.*; 3rd prize, *Diamond*. Mr. J. H. James kindly acted as officer of the day. On Easter Monday the club met the Cardiff Model Yacht Club for the fifth annual challenge cup match. A moderate S.W. wind blew at the start, which dropped considerably as the afternoon advanced, only, however, to freshen towards the finish. The race was sailed in three heats. In the first heat the Swansea boats were *Bona*, *Enid*, *Lavinia*, *Lady of the Lake*, and *Diamond*; Cardiff having *Mildred*, *Dodger*, *Aerial*, *Scillionan*, and *Vigilant*. Cardiff took first place with *Dodger*, Swansea taking second and third places with *Lady of the Lake* and *Lavinia*, respectively. In the second heat the starters for Swansea were, *Granville*, *Eleanor*, *Valkyrie III.*, *Rosemary*, and *Niagras*; the Cardiff boats being *Ivor*, *White Squall*, *Madge*, *Rover*, and *Captain Kettle*. Through an accident, *Rosemary* was delayed several minutes in starting. Cardiff took first and second places with *Ivor* and *Rover*; Swansea taking third place with *Granville*. The starters, therefore, for the final heat were *Lady of the Lake*, *Lavinia*, and *Granville* for Swansea; and *Dodger*, *Ivor* and *Rover* for Cardiff. *Dodger* finished first, thereby winning the cup and first prize, *Lavinia* taking second, and *Ivor* third. Mr. C. M. Lewis, of Aberdare, assisted by Mr. G. H. James presided over the match.

South Shields.—The second annual race for the silver cup, presented by Mr. T. N. Alexander, president of the South Shields Model Yacht Club, for competition amongst the clubs of Northumberland and Durham, took place in the South Marine Park, South Shields, on April 3rd and 4th. The race, which is for 10-ton yachts, was taken part in by six clubs, each having four yachts, and consisted of a full tournament, each yacht sailing against all the vessels of the opposing clubs. The wind on Monday the 3rd was N.W., and the course of a dead heat to windward, some excellent racing being witnessed. On being totalled up the scores were as follows:—Newcastle, 57 wins; Jarrow, 57 wins; Tynemouth, 45 wins; South Shields, 35 wins; Walker, 35 wins; Gateshead, 11 wins. Newcastle and Jarrow having tied, a tournament between these clubs was sailed on Tuesday the 4th, to decide which should hold the cup. The result was that Newcastle scored 11 wins against 5 for Jarrow, the former thereby winning the cup. Three prizes were offered for the yachts scoring the highest number of points. The first was won by Mr. J. Steven of Newcastle, whose vessel, the *Volant*, won 19 heats, losing only one. For second and third prizes three yachts tied, namely, Mr. T. Graham's *Falcon* (Jarrow), Mr. A. Williamson's *Venetian* (Newcastle), and Mr. J. Rox-

borough's *Foxhound* (Newcastle), each having won 16 heats in the original tournament. In the deciding heats *Falcon* beat *Venetian* and *Venetian* beat *Foxhound*. *Falcon*, therefore, took second and *Venetian* third prizes. The officials during the races were: Starters, Messrs. Thomas (South Shields) and H. Sharp (Tynemouth); and judges, Mr. George Waite (Newcastle) and Capt. W. A. Scott (Tynemouth).

Serpentine M.V.C.—On Saturday, April 8th, the Serpentine Club, of Hyde Park, held a race for 10-raters. The following seven boats were entered:—*Kite*, *Jubilee*, *Mohawk*, *Kestrel*, *Novice*, *Carress*, and *Swift*. The conditions as to points were as usual, but the wind was blowing great guns. The end of the first hour found the *Jubilee* leading by 12 points, the *Kestrel* and *Kite* having scored 9 each, the *Mohawk* with 7 being fourth. These boats then had to sail for another hour to decide the winners, and *Jubilee* again came out top. Curiously enough the *Kestrel* and *Kite* again tied for second place—the respective scores being *Jubilee* 15, *Kite* 13, *Kestrel* 13, *Mohawk* 5. It may, perhaps, be mentioned that the *Kestrel*, *Kite*, and *Mohawk* were seriously hampered by rowing boats, the *Mohawk* suffering especially from this cause. A race for 20-raters was held on April 22nd, of which we hope to give particulars in our next issue.

East Hull M.V.C.—On Saturday, April 1st, the members of this club held their opening race at East Park, the competing boats being 10-ton cutters. The first prize was a splendid album given by Mr. G. W. Barnes, and there were seven minor prizes given by the club. Eleven boats were entered, including the Hull champion, and runner-up for the East-coast championship, and also three new boats, showing that the club is in a healthy state. The first pair started at 3 o'clock in a N.W. baffling breeze, which increased towards the finish. The boats showing the best form were *St. George*, *Eagle*, *Falcon*, *Minerva*, and *Carrie*. After sailing off the heats it was found that *Eagle* and *St. George* tied for first place, and in a further trial between these two the *St. George* won, thus taking first prize. The other boats scored as follows:—(2) *Eagle*, (3) *Falcon*, (4) *Minerva*, (5) *Carrie*, (6) *Fannie*, (7) *Jamie*; *Jock*, *Flirt*, and *Jane* recovered their entrance-fees.

Tynemouth M.V.C.—A race for 10-ton yachts, postponed from March 25th, was sailed at Tynemouth Park on Saturday, April 8th, for prizes given by—1st, Mr. T. G. Dunn, Albert Inn, Tynemouth Road; 2nd, County Councillor Watson, Willington Quay; 3rd, Mr. T. Prentice, butcher, Saville Street. A splendid north wind blew with much force, the models carrying small sails and sailing at a rare pace. Ten yachts started, the course being a dead beat to windward, and excellent racing was witnessed, many of the heats being very closely contested. J. Stewart's *Maud* and T. Graham's *Falcon* each won 8 and lost 1 heat, therefore, tying for first place. In an exciting final *Maud* beat *Falcon*, after a good race. H. Sharp's *Breeze*, with 7 wins, was a good third. The following was the score of the yachts:

Wins. Losses.

J. Stewart's <i>Maud</i>	8	...	1 (1st.)
T. Graham's <i>Falcon</i>	8	...	1 (2nd.)
H. Sharpe's <i>Breeze</i>	7	...	2 (3rd.)
T. Foster's <i>Nymph</i>	6	...	3
W. Sharp's <i>Vixen</i>	4	...	5
F. Hudson's <i>Terror</i>	4	...	5
R. Park's <i>Ivanhoe</i>	3	...	6
J. Thompson's <i>Linnel</i>	3	...	6
R. Walton's <i>Fox</i>	1	...	8
C. Addison's <i>Undine</i>	1	...	8

Mr. T. Walters officiated as judge, giving every satisfaction.

The Edinburgh and Leith M.V.C.—This club commenced the sailing season on Saturday, April 1st, at the club sailing station (Inverleith). There was a good turn out of the members and spectators. The officials turned out to a man. There were twelve entries. The wind was blowing half a gale from west. Class I. started two minutes ahead of Class II., which class started two minutes in advance of Class III. The second class boat *Britannia* owned, designed, and built by Mr. McLennan (President) soon overtook Class I. She sailed splendidly and was much admired, and won by more than a length of the pond. *Venonica**, owner J. Harper, sen.) took second place; this boat got the lead after some of the rest got into grief. The Secretary's *Dean*, designed and built by the owner, sailed well at first; but came to grief on the second tack by colliding with the Treasurer's boat. Third place was taken by Mr. Kelly's *Lizette*; of this boat little can be said being a new one (new member). Mr. Marshall's *Whiteheather*, the holder of the Challenge Cup, made a very poor show and latterly had to give it up. All the rest finished the race.

Racing Fixtures for 1899.

South Shields Model Yacht Club.

- April 3—T. N. Alexander inter-club challenge cup, for yacht clubs in the counties of Northumberland and Durham.
 „ 15—Durham county shield.
 „ 29—H. S. Edwards' cup and first prize, presented by Messrs. Moncrief & Beck. Second prize presented by Councillor Pollard.
 May 13—10-ton race.
 „ 20—Moncrief cup.
 June 3—Eltringham cup for the length class.
 „ 17—15 ton race.
 July 8—5-ton cup race.
 „ 22—10-ton race.
 Aug. 5—15-ton race.
 „ 19—10-ton race.
 „ 26—Length class.
 Sept. 2—Consolation race.

Victoria Model Yacht Club.

- April 15—For Yachts A Class, 41 tons upwards.
 „ 22— „ B „ 31 to 40 tons.
 „ 29— „ C „ 21 to 30 „
 May 6— „ C „ 11 to 20 „
 „ 13— „ E „ 5 to 10 „
 „ 20— „ A „ 41 tons upwards.
 „ 27— „ B „ 31 to 40 tons.
 June 3— „ C „ 21 to 30 „
 „ 10— „ D „ 11 to 20 „
 „ 17— „ E „ 5 to 10 „
 „ 24— „ A „ 41 tons upwards.
 July 1— „ B „ 31 to 40 tons.
 „ 8— „ C „ 21 to 30 „
 „ 29— „ D „ 11 to 20 „
 Aug. 5— „ E „ 5 to 10 „
 „ 26—Annual Regatta (all classes), at 11 a.m.
 Sept. 9—Merchants' Regatta (all classes), at 11 a.m.

* The owner, Mr. Harper, claims this boat to have been built twenty years ago, and out of Robbie Burns' table. Your correspondent is not clear whether it was Burns' kitchen or parlour table.
 —J. McL.

Paisley Model Yacht Club.*Racing starts at 3 p.m.*

- April 8—Opening handicap.
 " 15—Mr. T. Scott's cup.
 " 22—Handicap race.
 " 29—Mr. T. Scott's cup.
 May 6—Juvenile handicap.
 " 13—Dr. Holms' medal.
 " 20—Handicap race.
 " 27—Handicap race.
 June 3—Open regatta.
 " 10—Juvenile handicap.
 " 17—Handicap race.
 " 24—Mr. Millar's prize.
 July 8—Handicap race.
 " 15—Juvenile handicap.
 " 22—Handicap race.
 " 29—Handicap race.
 Sept. 2—Handicap race.
 " 9—Sir Wm. Dunn's cup.
 " 16—Flag Officers' prizes.
 " 23—Sir Wm. Dunn's cup.
 " 30—Juvenile handicap.
 Oct. 7—Mr. Marshall's prize.
 " 14—Consolation race.
 Open Kegattas (open to members of recognised model yacht clubs) to be held on the water of various clubs, on the undernoted dates. Entries 1/-.
 Entries must be received by the secretary of the club holding the Regatta not later than the evening preceding, and can only be made through the respective secretaries.

Race starts at 4 p.m.

- May 6—Greenock at Greenock.
 " 20—Northern at Glasgow.
 June 3—Paisley at Paisley.
 " 17—Dennistoun at Glasgow.
 July 1—Springburn at Glasgow.
 Aug. 5—Alexandra at Glasgow.
 " 19—Maxwell at Glasgow.
 Sept. 2—Levern at Barrhead.
 " 16—West Burn at Whiteinch.

Edinburgh and Leith Model Yacht Club.

- April 1—Club race—All classes, 4 p.m.
 " 15— " " "
 " 29— " " "
 May 13— " " "
 " 23— " " 7.30 p.m.
 " 27— " " 4 p.m.
 June 6— " " 7.30 p.m.
 " 10— " " 4 p.m.
 " 20— " " 7.30 p.m.
 " 24— " " 4 p.m.
 July 8— " " "
 " 18— " " 7.30 p.m.
 " 22— " " 4 p.m.
 Aug. 5— " " "
 " 19— " " "
 Sept. 2— " " "
 " 16— " " "
 " 30— " " "
 Oct. 14— " " "
 " 28— " " "

Challenge Cup Competition.

(Present Holder—Mr. J. MARSHALL.)

- Aug. 5—First Heat—Class 1, 4 p.m.
 " 19—Second " " 2, "
 Sept. 2—Third " " 3, "
 " 16—Fourth " " 4, "
 " 30—Semi-Final
 Oct. 14—Final

Manchester Model Yacht Club.

- Mar. 25—15-raters.
 April 8—Handicap (for all boats).
 May 6—15-raters.
 June 3—Handicap (for all boats).
 July 1—15-raters.
 " 29—Handicap (for all boats).
 Aug. 26—15-raters.
 Sept. 23—Handicap (for all boats).
 Oct. 7—Handicap consolation for all members not having won a first prize during Season 1899.
 " 21—Championship tournament for all boats having won a first prize during Season 1899.

Correspondence.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication. Communications should be written on one side of the paper only.]

Wanted—An Inter-Club Measurement Rule.TO THE EDITOR OF *The Model Engineer*.

SIR,—I hail with delight the prospect of our being able to communicate with each other through your promised supplement on model yachting. Since the death of that excellent little journal, the *Model Yachtsman and Canoeist*, there has been a void, and want of sympathy between the clubs, and no doubt some clubs have gone spark out for want of a guiding-spirit like the genial editor, Mr. Bruce.

I should strongly advocate some inter-club, or general measurement, rule at this new beginning; so that model yachtsmen, on visiting other towns, may find worthy competitors. As it is now, we have on our lake perhaps twenty strange boats of different shapes and sizes; so that friendly competition only takes place with the club boats. I may instance the immense benefit that yachting has received from the one class one design rule. If this should meet the eye of Mr. Bruce, perhaps he would kindly give us his advice. As far as I can, I shall have pleasure in giving some of my forty-five years' experience. —Yours faithfully,

A. FORDSMITH,

Vice-president Leeds Model Yacht Club.

[We shall be glad to have the opinions of other readers on the point raised in the above letter.—ED. *M. E.*]

Model Yachting Prize Competition.

WE offer two prizes of 10s. 6d. each for the best two photographs of successful model yachts. Each photograph sent in for competition must bear the sender's name and address, and must be accompanied by a short description not exceeding 500 words, describing the principal features and dimensions of the boat, and also giving brief particulars of her sailing successes. Each competitor may only submit one photograph, and should enclose stamps if the return of same is desired, in the event of non-success. The Editor's decision must be regarded as final, and we reserve the right to reproduce the winning photographs and descriptions in our pages. Competitions should be addressed to The Editor "THE MODEL ENGINEER," 6, Farringdon Avenue, London, E.C., and should be marked outside "Model Yachting Competition." The last date for sending in is May 10th.

The Editor's Page.

A PLEASING indication of the way in which the circulation of THE MODEL ENGINEER is extending is to be found in the increased number of letters we are receiving from readers abroad. We have within the last few days heard from several readers in the United States and Canada, and also from others in Burma, New Zealand, and South Africa. We need hardly add that we are always pleased to hear from our foreign and colonial readers, and especially to have particulars of their model-making experiences abroad.

In our March issue we published an intimation from "J. E. M." (New Hampshire, U.S.A.), that he was desirous of corresponding with English readers of THE MODEL ENGINEER. We are glad to know that his wish has been gratified, to some extent at least, for we have just received a further letter which runs as follows:—"I am much gratified to see my request printed on p. 55 of the current (March) number of THE MODEL ENGINEER, and it gives me still more pleasure to receive letters stating that they have seen my notice. Mr. A. P. Drake wrote me a very nice little letter, and I also received a catalogue from F. & H. Shaw, Hebden Bridge. Mr. Drake, as you doubtless know, is a contributor to the M.E., and a resident of Bradford, England, and I cannot but think what a contrast there must be between his city and its namesake here among the hills. I intend to send him some photographs of the town here and of my workshop, and will ask him to forward them to you, that you may see what the country is like here. I am now engaged in making an 18.-ft. launch to use the coming summer. I shall put it overboard as soon as the ice leaves the lake here, and I may say we have had the longest winter known for years. It snowed November 25th, and we have not touched a wheel to the ground since. The ice is 21 ins. thick in the pond near my house. I forgot to say the power for my launch is a gasoline engine, made by the D. M. Tuttle Company, Canastota, New York, U.S.A., 1½ h.-p."

Mr. H. E. Morriss, the author of the article on building a fast model torpedo-boat destroyer, which appeared in our March issue, informs us that he has been overwhelmed with letters and post-cards containing requests for further advice on the subject. While he is quite agreeable to help each and every one of his correspondents as far as possible, he asks us to mention that he thinks it only right that all who wish for a reply to their letters, should enclose a stamped addressed envelope for that purpose. As he has had, in all, some hundreds of letters asking for information, he has been unable to attend to the enquiries of those who have not done their duty on this point.

Entries for our Prize Competition (No. 6) for the article on "How to Make a Model Electric Motor Car," must be sent off not later than April 30th. Will intending competitors please note?

With further reference to the subject of paying for price-lists, we have received the following note from "A. P. D." (Bradford):—"I have read 'T. M.'s' letter in the April issue, and may mention that my firm received from a 'T. M.' at Crewe a post-card, which the proprietors of Colman's starch and blue give away for the asking, of course, the card having their advertisement on the back. On the card was written, 'Send lists to above address.' Now, for pure cheek this will stand a good chance of 'taking the bun.' I do not mean to suggest that both the 'T. M.'s. are identical, as I do not think the 'T. M.' who wrote us would waste a stamp in writing to you on the subject, not to speak of his evidently valuable time. I note with pleasure that you explain the advertiser's position in this matter, and show that far from making £1 per thousand profit on his lists, he generally loses about £1 per hundred, or even more, until he clears off the capital expended on blocks, etc."

On this same topic Mr. C. L. Ford, of Stalybridge, whose name will be familiar to our readers as a constant advertiser, also writes:—"I notice T. M.'s (Crewe) remarks, and, as an advertiser, I think them very unjust, and must say he, or anyone else, who won't send a stamp for any lists, are, in my opinion, too mean to buy. In fact, I never send lists to anyone who sends a post-card for one, for I think they are not intending buyers. Also, anyone who intends to buy will willingly spend a penny on a letter and a penny for return post. Take, for instance, 'T. M.' states advertisers make a business out of their lists, which I know is not true, for my own case. My lists are £2 10s. per 1000, and envelopes 10s. per 1000, or £3 per 1000 in all. Then there is 1000 halfpenny stamps, which is £2 1s. 8d. So lists and stamps cost me over £5, and I send out about 1000 a month; so, instead of making money on my lists, I really lose, roughly, £1 per month, even when readers send a penny stamp. I should be pleased if you could put this in your valuable paper, so readers can see both sides of the question."

New Prize Competitions.

COMPETITION No. 7.

TWO PRIZES of £1 is. each are offered for the best descriptions of how to make a working model suitable for driving from a small engine or gas engine, or electric motor. The model described may be a miniature machine tool, crane, pump, or agricultural machine, printing press, or any mechanical model with which the competitor is familiar. Full working drawings should accompany the description.

The closing date for this competition is June 30th. (See *General Rules*.)

GENERAL RULES.

For general rules governing this competition see previous issues of THE MODEL ENGINEER.

All competitions should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.

The Society of Model Engineers.

THE usual meeting of the Society of Model Engineers was held at the Memorial Hall, Farringdon Street, E.C., on Friday, April 7th, some forty members and friends being present. From 7 o'clock until 8 o'clock the time was employed in an inspection of the many models, &c., displayed by members. Several dynamos were on exhibition, the best of which were

Mr. Pearce's hand-driven overtype machine, with driving gear, developing 1 ampere at 15 volts,

A. W. Roy's charging dynamo, made for an output of $3\frac{1}{2}$ or 4 amperes at 8 volts, at 3000 revolutions.

Mr. Rompler exhibited a Crypto slow speed dynamo, wound to develop a current of 8 volts 1 ampere at the very low speed—for so small a machine—of 1,500 revolutions per minute, and 20 volts 2 amperes at 2,200 revolutions.

Mr. Pearce's machine was pressed into the service of supplying current to

Mr. H. Hildersley's half-inch spark coil, which has for primary two layers of No. 18, and for secondary one pound of No. 32.

Another interesting exhibit was a watchmaker's lathe, the use of which was clearly explained, and which created much interest.

At 8 o'clock, the formal business having been disposed of, the chairman, Mr. PERCIVAL MARSHALL, proceeded to lecture upon the subject of "Tools for Metal Turning." The correct angles and shapes for the edges of metal-cutting tools were plainly shown by sketches on a blackboard, the lecture being principally devoted to the consideration of slide-rest tools in common use. A number of interesting tool-holders for small lathes were exhibited and explained by the lecturer, these having been kindly lent for the occasion by Messrs. H. Milnes, M. S. Don, and F. P. Spicer.

Mr. Marshall proposed to discuss other branches of the subject at a later date. The lecture led to a useful discussion, many questions being also asked.

Mr. Crebbin was next called upon to speak on the subject of his smart-looking model loco, "No. 3, G.M.R.," which had been inspected earlier in the evening. Mr. CREBBIN said that "of course" his model was a broad-gauge one, as he is a believer in that gauge for models. After further explanation, the speaker went on to describe, by the aid of sketches, his design for a really express model loco, of $3\frac{1}{2}$ -in. gauge, the principal features to be a very large firebox and the use of oil fuel, together with oscillating cylinders. A few questions having been answered, the meeting was brought to a close.

THE NEXT MEETING.

The next meeting of the Society will take place on Monday, May 8th, at 7 o'clock, at the Memorial Hall, Farringdon Street, E.C. In addition to the usual exhibits of models, of which some interesting examples have already been promised, a discussion will take place on the subject of "Permanent Way for Model Railways." It will help to make the discussion much more interesting and instructive if members who have model railways will bring up specimen portions of their track, switches, or signalling arrangements, &c. The formal business of the evening will commence at 7.30 instead of at 8 p.m., as hitherto, and will terminate at 9 o'clock as nearly as possible. This will enable members wishing to leave early to do so without missing any portion of the discussion. The meeting will not close till the usual hour—viz., 10 o'clock.

The following meeting of the society will be held on Tuesday, June 6th.

THE LIBRARY.

The librarian has to announce continued progress in the number of books added to the library. During the past month the following books have been presented by Mr. A. W. Roy, of Newcastle-on-Tyne, namely: "How to Make a Wimshurst Electric Machine," "How to Make a One-eighth Horse-power Dynamo or Motor," "How to Build a One-half Horse-power Dynamo or Motor," and "Electric Tramways and Railways Popularly Explained."

PROVINCIAL BRANCHES.

SHEFFIELD.—The monthly meeting was held at the residence of Mr. Shaw, 31, Catherine Road, Sheffield, on Tuesday, April 11th, the chair being taken at 7.30. The first part of the evening was occupied by ordinary business, several new members being enrolled. The chairman was able to announce that a room of the hall belonging to the Y.M.C.A. had been engaged in which to hold future meetings; it was decided to hold them on the second Thursday in every month. The rest of the time was spent in inspection of the various models, etc., provided by the members. Mr. Shaw exhibited a model steam hammer, which he worked by means of compressed air. Mr. A. Skinner showed his model steam launch engine, which was described in THE MODEL ENGINEER of 1898. This splendid model was much admired by all present. As some members were absent owing to illness, Mr. Skinner kindly offered to exhibit it once more at the next meeting; he was warmly thanked for his kind offer. This gentleman had also brought down the bed-plate of a model G.N. locomotive, now in course of construction. Other models were also shown. The next meeting will take place in the above hall on May 11th, the chair to be taken at 7.30 prompt.

BRADFORD.—The second monthly meeting of this Society was held on Monday, April 10th, when there was a good attendance, several new members being enrolled. It was decided to fix the subscription at 5s. per annum, payable in two instalments; it was also decided to fix the entrance-fee at 1s. 6d. All members joining at or before the next meeting, May 8th, to be exempt from payment of entrance-fee. The age limit was fixed at 18 years and upwards. A model undertype dynamo, made by Mr. T. H. Wilson, was shown, and was admired by all present. Mr. Spicer kindly lent his model enclosed steam-engine and pump, which were considered marvels of ingenuity and compactness. The best thanks of the members were accorded to Mr. Wilson and Mr. Spicer for their exhibits. The next meeting will be held on Monday, May 8th, at 7 p.m., in the Tyrrell Street Coffee Tavern, Bradford, when all interested in model-making will be heartily welcome.—JOHN HEY, Secretary, 14, Balfour Street, Bradford.

Carbon-Consuming Batteries.

AT a meeting of the Institution of Junior Engineers, held at the Westminster Palace Hotel, on March 3rd, the chairman, Mr. Basil Joy, presiding, a paper on "Carbon-Consuming Batteries and their Possibilities," was read by Mr. W. R. Cooper, B.Sc., M.A., M.Inst.J.E. There was a large attendance.

The saving which might be effected in the cost of production of electrical energy by the use of a carbon-consuming battery was first discussed. The absolute mean efficiency of a steam plant, generating electrical energy for general supply purposes, might be taken as low as 6 per cent., as deduced from experiments by the late Mr. Williams, whereas the corresponding figure for a battery working under the same conditions was about 73 per cent. Assuming that a Board of Trade unit could be generated and distributed by the combustion of 10 lb. of

coal, and that the cost per unit was 3'3d., with coal at 20s. per ton, then the efficiency of a battery rendered it possible to effect a saving of 30 per cent. of the cost per unit, provided that coke could be voltaically oxidised to CO_2 , and that the electrolyte and the plate opposed to the carbon did not introduce additional expense. The cost of renewing the electrolyte and the negative plates however, might counteract the gain due to efficiency. It was also necessary to remember that the cost per unit depended upon maintenance, and that the price at which electrical energy could be supplied depended upon capital expenditure. For the consumer to derive much benefit from a carbon-consuming battery, a reduction in the capital expenditure as well as in the coal bill must be effected.

The author next considered the various difficulties in attempting to solve the problem of the direct production of electricity from carbon. They were due to (1) the insoluble nature of carbon; (2) the scarcity of electrolytes among carbon compounds; (3) the inability of carbon to act as an ion in such organic compounds as are electrolytes; (4) the electro-negative character of carbon. In the place of the oxidation of carbon, that of CO might be attempted; but the possible E.M.F. from such a re-action was lower than that theoretically obtainable from the oxidation of carbon. There was also a difficulty in finding electrolytes in which CO acted as an ion.

Suggestions for various forms of carbon-consuming cells were then reviewed. Grove's ordinary gas cell, in which the hydrogen may be replaced by CO , was of no commercial value, because the current obtainable appears to depend upon the rate of occlusion of the gases by the platinum. The cell brought out by Borchers with a view to the utilisation of CO , had not proved successful; the E.M.F. was, in fact, not due to the oxidation of CO , but to the solution of the copper, which is used as one of the plates. The problem had been attacked by Reed in a manner which was suggestive, but without much practical result. This investigation aimed at a cell having indestructible electrodes, and an electrolyte by means of which the carbon was oxidised, but which was regenerated by the action of the cell itself. The indirect production of electrical energy from carbon by the use of H_2S and SO_2 was ingenious, but no practical outcome could be obtained by the interaction of two liquids, because true voltaic action does not take place in that way. The utilisation of free carbon, combined with electrolytic solutions, had been attempted by Case and by Coehn. The Jacques cell was an example of one in which a fused electrolyte was employed. Owing to the many defects which are inherent in this form of cell, its efficiency was low; it also appeared extremely doubtful whether the electrical energy obtained was due to the voltaic consumption of carbon at all. Another cell of the same class was Blumenberg's, in which the same objectionable features were to be found, as in the case of the Jacques cell.

The *Scientific American* has recently received from J. J. Gilchrist, of East Las Vegas, New Mexico, a description of an engine built at a factory in that place by W. L. Adion. It is a passenger locomotive built to a scale of 1 inch to the standard, and measures 4 ft. 7 ins. from the top of the cowcatcher to the back drawbar. The boiler is 20 ins. long, and the height from the rail to the top of the stack is 17 ins. The diameter of the driving wheels is 5½ ins.; the cylinders are 1½ ins. by 2½ ins. The little locomotive has been used to run up and down the centre of a dining-table, with small cars attached, to facilitate waiter service. We have heard of miniature electric railways being used for the transportation of viands, but we have never before heard of a locomotive engine being used for this purpose.

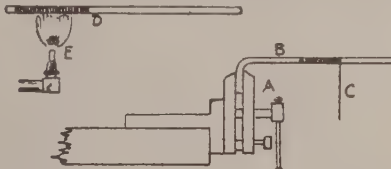
Practical Letters from Our Readers.

(The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a non-descript name if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.)

Making Spiral Springs.

TO THE EDITOR OF *The Model Engineer*.

SIR,—The following is a simple way of making springs by the aid of a vice and gas-jet:—First select a steel rod of the right proportions to make the spring desired, and secure it in a bench vice, as shown in the figure in which A is the vice and B the rod. Wind the wire around this rod, as shown by C, but first take out the temper if the wire is too stiff. Wind the wire close and evenly; then secure the ends of the wire so that they will not unwind; next heat both rod and wire to a red heat and



plunge them into cold water. If an open spring is desired, draw it to right dimensions before hardening. The final process requires that the wire shall be rubbed with oil and held over the flame (E) as shown until the oil is burned or dried off. The rod and wire are marked D. The spring is now ready for use.—Yours truly,
Edinburgh. S. S. L.

Soldering Aluminium.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Here is a formula for soldering aluminium, which I have tried and found fairly successful. Take equal parts tin and zinc: melt and run into pencils about the size of 10 B.W.G. wire. It needs no flux, but the metal must be kept very hot in a gas or other flame while being applied. It is a hard solder, and must be blowpiped on. Adding about 3 grs. of nitrate of silver to the ounce improves it somewhat. J. E. M.

Bradford, N.H., U.S.A.

Electric Clock Alarms.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Having seen a lot about electrical alarm clocks in *THE MODEL ENGINEER*, I thought you would like to have a description of one I have made. It is of the nickel drum pattern, an alarm that would not work. Having taken the back off and the works out *en masse*, I proceeded to run an insulated wire to the front of flat brass spring which holds the hammer until the hands arrive at the time at which the alarm is set, when it is released and springs forward about ¼ in.; this wire was fixed near enough to make a contact when spring was released. A hole was then made in the back of clock, through which was passed the other end of the insulated wire, which was then coiled into a helix. Then I made a small wooden bracket to stand the clock on, fixed a copper plate on the bottom, and piece about as big as a penny; one was connected to battery the other to bell, the other battery wire to the bell through switch. The clock, on being placed on bracket, stands on copper plate,

and the helix presses against the disc at the back, the end of wire being bared. In this way the current can be stopped either by moving clock forward or switch, and can be taken down and wound up without any inconvenience, at the same time set to go off at any time by means of alarm hand, and it never fails to act.—Yours truly,

Reading.

H. M. B.

Soldering Zinc.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Seeing reply to Query No. 599, in No. 15 of *THE MODEL ENGINEER*, re soldering zinc, and thinking that no doubt that my brother amateurs are in the same fix, I think it may be interesting to our readers to know my experience on a job of this sort I had in hand a few days ago. Like "W. O.," I was trying to solder some zinc, and could not get the solder to take till I tried raw spirits of salt mixed with water, 1 of spirits to 2 of water. Using this as flux, I found it go as easy as a piece of tin, and had no further trouble with it.

I think the joint should be washed afterwards.

Fareham.

J. D., R.A.

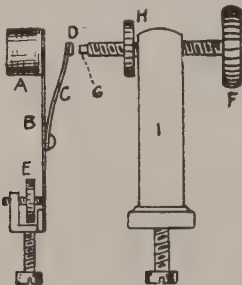
Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to *The Editor, THE MODEL ENGINEER*, 6, Farringdon Avenue, London, E.C.]

The following are selected from the queries which have been replied to recently:—

[746] P. J. W. (Tottenham) writes: Please could you show me (by sketches, &c.) the construction of, and explain the working of, the most simple and suitable contact breaker for a 3-in. spark induction coil, and would you kindly tell me whether 3 lb. of No. 36 silk-covered wire would be sufficient, if I work the coil with 4-pt. bichromates?

Annexed is sketch of one of the most useful and efficient forms of contact breaker. A is the soft iron hammer head attached to (B) a



fairly strong spring; to this is fastened a rather weaker spring (C), which carries a platinum contact stud (D) at its upper extremity. The resiliency of the mainspring (B) is controlled by the screw (E). The contact screw (F) is tipped with platinum at G, and is prevented from travelling back by the back nut (H). The pillar is of brass, as usual. This contact breaker, owing to the second spring (C), allows the core of the coil to magnetise to the full before contact is broken. 3 lb. No. 36 will do well for a 3-in. spark coil. A 3-in. spark coil usually requires about six quart bichromate cells, or six accumulator cells.

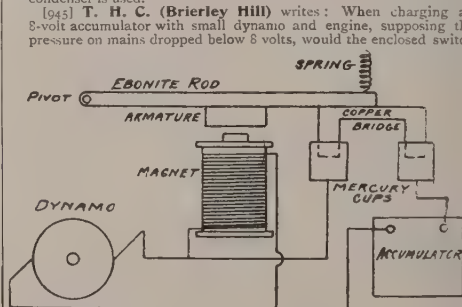
[759] W. D. (Bethnal Green) writes: I have a bobbin 3 in. long inside flanges, and 2 in. diam., the core $\frac{1}{2}$ in. diam., and is flush one end and projects $\frac{1}{2}$ in. at the other. It is wound with six layers of this size wire for primary, and $\frac{1}{2}$ lb. of this size wire for secondary. The first layer of primary has six very fine

wires fastened to it about $\frac{1}{8}$ in. apart, which are brought separately to six holes about $\frac{1}{8}$ in. apart on the outside edge of the flange where the core projects. What are these for, and what are they connected to? I have also $\frac{1}{2}$ lb. of this size wire to spare. Can I wind it on the secondary with any benefit? Will you also tell me what size to make the condenser, and what size spark might I expect to obtain, and how many bichromate cells to use? I have six $1\frac{1}{2}$ pint ones made as described in your first issue of *THE MODEL ENGINEER*.

Your coil was evidently intended for a medical coil, and the purpose of having six ends from the primary was to enable six varying "powers" or strengths of current to be sent to the patient. But you would not be able to use this arrangement if you propose making it up as a spark coil. Your best plan will be to wind on as primary two layers of the coarsest wire sent as sample; to paraffin this well with hot melted paraffin, then cover once with about seven turns of stout brown paper, carefully and tightly rolled on and stuck down at each turn with thick shellac varnish; when done give a fine coat of varnish all over the brown paper tube, and when dry wind in about $\frac{1}{8}$ in. of your finest wire as evenly as you possibly can. Baste each layer as you put it on with hot melted paraffin, and cover with one turn of paraffined paper; the two ends of the secondary wire should come right through the bobbin end, so that the successive layers of the secondary should not be near the starting end thereof. Fifty sheets of tinfoil, 3 in. by 5 in., interleaved with a paraffined paper, will make a suitable condenser for this coil. From two to three of your bichromate cells will be enough to work this coil, which, if carefully made and well insulated, should give from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. spark.

[680] Boiler for Two Cylinders, $1\frac{1}{2}$ in. $\times$ 2 in. F.C. (Bristol) writes: (1) Would a boiler 6 in. by 30 in. barrel made from 3-znds., and flat ends made from 1-8th copper, and three 1 in. tubes, with out side fire 2½ in. deep in front, 3 in. deep paper back, 3 in. wide at bottom, and 10 in. long, to go along bottom of boiler, then through tubes, and then round the sides and chimney, give enough steam for a pair of cylinders $1\frac{1}{2}$ in. by 2 in. (2) Which would be the best material to make it of to stand the highest pressure—brass or copper? (3) Do you think I could get better results from a single cylinder 2 in. by 3 in.? Why I thought of having the two smaller ones was because I intended to run a dynamo with it. I thought the speed would be more even. (4) Would a compound engine be better with cylinders 2 in. by 3 in., 4 by 3 in. Would there have to be a valve between high and low pressure cylinders, or would the steam go direct from high to low? Would there have to be a receiver, because when high pressure let the steam go the low would not be ready to receive it, cranks being at quarter, and must there be an exhaust pump? (5) The boiler would run the engines, but not very fast. It is too long in proportion to its diameter. A better proportion would be 8 in. diam., 24 in. long, with two 2 in. tubes; grate, 6 in. wide by 12 in. long. (6) Copper would be the best metal, and if double rivetted would be safe at 50 lb.; the end plates should have several stays above the tubes. (7) The single cylinder would give slightly more power, and at 300 revs. the speed would be even enough for a dynamo. (8) A compound engine would not do better unless the boiler pressure was about double, and the cylinders if $1\frac{1}{2}$ in. by 2 in. and 2½ in. by 2 in. would give more power than the 1½ in. by 2 in. engines. Each cylinder will act as receiver. No air pump necessary unless a condenser is used.

[945] T. H. C. (Brierley Hill) writes: When charging an 8-volt accumulator with small dynamo and engine, supposing the pressure on mains dropped below 5 volts, would the enclosed switch



act for breaking the circuit? The magnet to hold armature down with a pressure of 8 volts or above, against pull of spring, which should overcome power of magnet when volts fall below eight. How large a magnet must I use, with quantity and size of wire on same; and must it be connected in shunt or series?

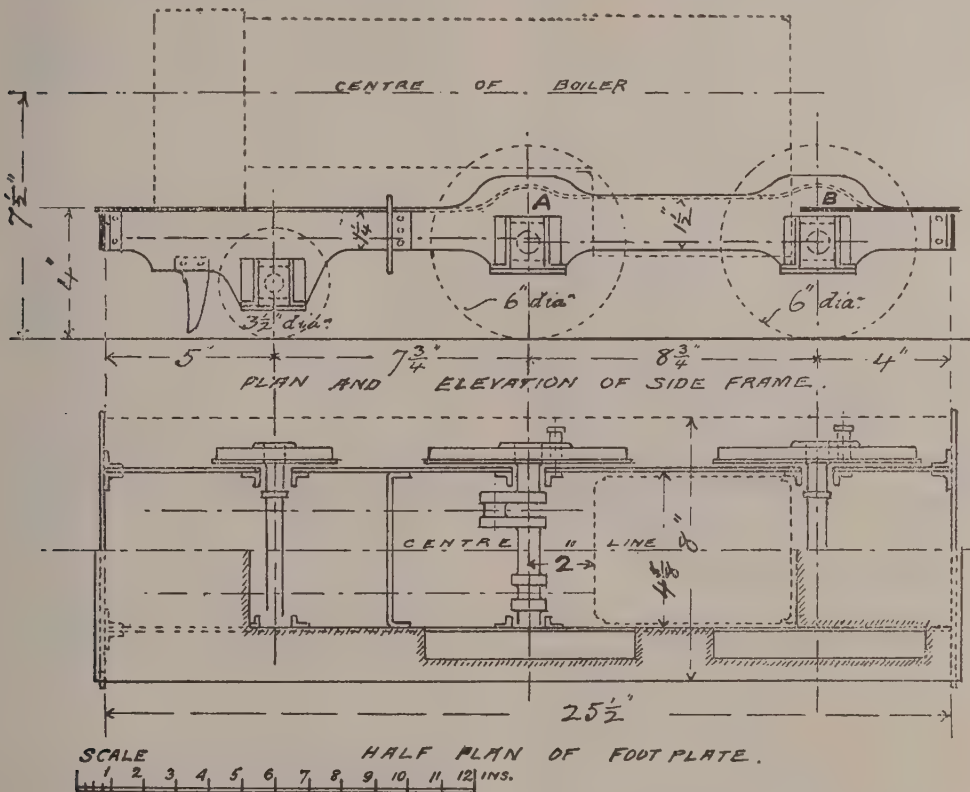
In charging an 8-volt accumulator you will require a pressure of 10 volts, since each cell takes 2½ volts to charge it. Your automatic cut-out is an old form known as Cunyngham. For so small an affair let your magnet core be about $\frac{1}{8}$ in. diam., 2 in. long, wound with No. 14. Put this in series with the dynamo and accumulator, and regulate the voltage by the tension of the spring.

[677] **Vertical Boiler, 24 in. by 12 in.** J. N. H. (Kidderminster) writes: I am making a vertical boiler, 12 in. diam., 24 in. high, with enclosed furnace, out of 1-16th in. sheet iron, crown plates same thickness, rivets $\frac{1}{2}$ in. apart. There are also seven tubes 1 in. diam. Would you kindly tell me—(1) What pressure ought it to work at, and also what pressure ought I to test it to? (2) What brake h-p. would it work an engine $1\frac{1}{2}$ in. bore, 3 in. stroke? (3) What solder ought I to use? (4) The rivets are $\frac{3}{8}$ in. diam., and I have put them in cold. Will that matter?

(1) About 20 lb. per square in.; test to 40 lb. with water. (2) About $\frac{1}{8}$ h.p. if run at 400 revolutions per minute, steam being cut off at two-thirds stroke. (3) Tinman's solder can be used if the parts are first scraped clean. (4) No; the solder will probably stop any leaks. It would be better if the crown plates were a little thicker, say $\frac{1}{8}$ in. The tubes must be put in tight, and rivetted over at the ends to act as stays between crown plates.

[684] **Boiler (8 in. by 2 in.) for Model Loco.** H. G. A. (London, W.C.) writes: In making a boiler about 8 in. long by 2 in. in diam. for model loco, would one tube, say $\frac{3}{8}$ in. diam., to act as a flue for heat to go to chimney, be sufficient to raise steam and keep engine (about 12 in. bed) going? In making boiler, would 1-16th in. brass tube be thick enough to withstand the necessary working pressure, and what must that pressure be?

It would be best to put in two $\frac{3}{8}$ in. tubes; these, with the addition of the firebox surface, should raise enough steam. 1-16th in. brass would be plenty thick enough; it need not be more than 1-20th in. thick for a pressure of 15 or 20 lb. If the length of 8 in. includes the firebox, it can be made as described below. First make a saw cut across the tube, not quite half-way through, and about 2 in. from end of tube, and then another cut lengthways from centre of first cut to end of tube, then open out from sides of firebox.



SIDE FRAME AND FOOT-PLATE FOR MODEL L. & N.W. RAILWAY LOCO. (Query No. 1029.)

[1029] **L. & N.W. Express Engine.** H. G. (Stoke Newington) writes: I have made a boiler according to the answer to a question from Ireland (query No. 160), and I want to make an inside cylinder, something like a London & North-Western Express, and if you could tell me where to get drawing of the side frames and bed-plate, or oblige me with same I should be very much obliged.

The accompanying tracing shows side frame and footplate suitable for the boiler referred to, and is something like the four-coupled inside cylinder express engines of the North-Western Railway. The side frames can be of iron or mild steel, $\frac{1}{2}$ in. or 3-pands. in. thick, and the footplate or bedplate 1-16th in. thick, 8 in. wide, and about 26 in. long. It is curved, as shown by dotted lines at A and B, to clear the coupling rod. The shaded edge shows the portion cut out to clear driving-wheels, firebox, and motion.

[683] **Boiler for Two-Cylinder Launch Engine.** V. J. W. (Sheffield) writes: I wish to make a copper boiler for a double-cylinder launch engine; cylinders, 2 in. stroke, $1\frac{1}{2}$ in. bore; boat about 6 ft. long, and steam pressure 45 lb. to 50 lb.; charcoal to be used as fuel. I had thought of a boiler something after the style of that described in Query 58, in the March number. Would you kindly give me the correct dimensions and gauge of copper, and state what pressure I should test to?

Boiler may be 15 in. long, 6 in. wide, and 8 in. high, with flue tube 5 in. diam., 1-16th in. thick; grate, 8 in. long with firebrick bridge and several diagonal water tubes. Test to 70 lb. per square in. It would be better to stay the flat sides of boiler as shown in Query 58; cut from sheet metal $\frac{1}{8}$ in. thick, and rivetted to sides of boiler.

[346] E. W. (St. Leonards-on-Sea) writes: I have bought an arc lamp, and should be glad if you would inform me whether the resistance should be on the positive wire or the negative. I should also be obliged for particulars as to reading of ammeter and voltmeter for charging a 12-volt accumulator, Q type E.P.S., charge 2 to 4 amperes. I use as a resistance a coil of steel wire which came out of a 4-ft. spring blind-roller. Should I be right in running dynamo (a 50-volt 6-ampère one, driven by 1 h.p. Gardener gas engine) till voltmeter reads 18 volts, and then switching on? Or should I be guided by the reading of the ammeter, and keep that at 3 to 4 amperes, and not trouble about volt or trusting to the resistance? About how long should it take to fully charge, and would it do it good to let it boil up furiously or stop when small bubbles appear?

It is really indifferent whether the resistance for arc lamp be put on the positive or negative main. Referring to the 12-volt Q type accumulator. You need not trouble about the exact voltage, provided, of course, it be not less than 15 volts. What you have to do is to keep the current as steadily as possible at 3 to 3.5 amperes; this, of course, means that as the cells get charged, you must gradually decrease the added resistance, since the back E.M.F. of the cells themselves acts as a resistance, which increases with the increase of charge. It is never well to make the acid "boil furiously"; this serves no use useful purpose, but may heat and buckle the plates.

[676] Boller for Model Horizontal Engine. G. G. (Gateshead) writes: I am making a model of a 3 h.p. single horizontal engine—cylinder, 6 in. diam., 12 in. stroke, boiler pressure, 30 lb. per square in.; cut-off, $\frac{1}{2}$ in. stroke; revolutions per minute, 80. My model is one-third this size and I should be much obliged if you could kindly give me dimensions and sketch of a suitable vertical boiler, and what would be the best material to make it of.

For an engine with cylinder 2 in. bore and 4 in. stroke, the boiler should be 15 in. diam. and 2 ft. 6 in. high. Copper would be the best material, and for a pressure of about 40 lb. use plates $\frac{1}{8}$ in. thick for shell, and 3-16th in. for crown plates. Firebox shell, 13 in. diam. at bottom, and 12 in. at top, and 14 in. high. Put in seven fire tubes, $\frac{1}{2}$ in. diam.; rivets $\frac{1}{4}$ in. diam.; $\frac{3}{4}$ in. pitch.

[682] Boller for Loco. 17 $\frac{1}{2}$ in. long. C. B. (Newport, Salop) writes: I am making a model loco, and should like you to answer me the following questions. It has two driving wheels, 5 in. diam., and four leading and trailing wheels, 3 in. diam.; length of bed, 17 $\frac{1}{2}$ in., width, 5 in.; outside slide-valve cylinders, 1 in. by 2 in. I want to know what size the ports must be made, also what size boiler and how to make the fire and smoke boxes. It is to have some tubes, and to burn spirit lamp firebricks. I have also some plates. Can you give me full directions for making boiler of copper, what thickness, &c.? Any hints will oblige at earliest. Stamped addressed envelope enclosed.

Steam ports, $\frac{1}{2}$ in. by 3-32nds in.; exhaust ports, $\frac{1}{2}$ in. by 3-16ths in.; bridges, 3-32nds in. wide; valve 11-16ths in. long, $\frac{3}{4}$ in. wide, with a cavity $\frac{3}{8}$ in. long by $\frac{1}{2}$ in.; travel $\frac{1}{4}$ in.; harrel of boiler, 3 in. diam., 7 $\frac{1}{2}$ in. long; outside firebox, $\frac{1}{2}$ in. long by $\frac{1}{2}$ in. wide; inside firebox, $\frac{3}{4}$ in. long by $\frac{1}{2}$ in. wide, and $\frac{1}{2}$ in. deep. Boiler should have five $\frac{3}{4}$ in. tubes, about 8 in. long. Construction similar to sketch in the July number. Copper 1-16th in. thick.

[762] W. E. G. (Leith) writes: Would you be so very kind as to let me know the sizes and amounts of wire for a 2-in. and 3-in. spark coil, to run off a dynamo giving 25 amperes at 5 volts pressure? The bundle of iron wire is 12 in. by $\frac{1}{4}$ in. No. 28 B.W.G. Please state probable diameter of coil, and also amount of tinfoil in condenser.

Presuming you desire to use the whole of the 25 amperes which your dynamo is capable of giving, you would do well to wind the primary of your proposed coils with No. 12 D.C.C., of which about 4 lb. would be needed for either of them; over this, separated by a ebonite tube, which should be $\frac{1}{2}$ in. thick for the 2-in. coil, and $\frac{3}{4}$ in. for the 3-in. coil, you will wind No. 36 silk-covered wire (2 lb. for the first and 1 lb. for the second), each wire being, of course, basted with hot paraffin wax, and covered with one turn of paraffined paper. Finished diameter of former, about 3 in.; of latter, about 3 $\frac{1}{2}$ in. The condenser, in either case, should consist of 100 sheets of tinfoil, 12 in. by 6 in.

[779] A. L. H. (Leamington) writes: Will you kindly give me the following particulars about an induction coil to use for x-ray experiments? Coil to give 6 in. spark. There are as follows: core and diameter of same; length and diameter of primary coil; length and diameter of secondary coil; best form of interrupter; size and thickness of tinfoil for condenser; the best place to procure the fittings required.

For a coil to give 6-in. sparks, specially for x-ray work, we do not think you can do better than follow the directions given by S. Bottone in his work on Radiography. There are as follows: core Iron bundle of No. 18 B.W.G. annealed iron wire, 15 in. long 1 $\frac{1}{2}$ in. diam.; primary wire, four layers, No. 14 double silk-covered copper wire, about 3 lb.; ebonite tube over primary, 14 in. long, 2 $\frac{1}{2}$ in. inside, 2 $\frac{1}{2}$ in. outside diam.; ebonite heads, 6 in. square, $\frac{3}{4}$ in. thick; seven vulcanised fire circles, $\frac{5}{8}$ in. diam., $\frac{1}{2}$ in. thick; secondary coil, 7 lb. No. 35 double silk-covered copper wire; condenser, sheets of tinfoil (32 in. by 12 in.) each being of contact breaker, with double spring, to ensure long contact and quick break, see p. 100 of the present issue. It is invidious to

recommend one firm among so many, but we think you would be satisfied if you applied to the above-mentioned firm, which also publishes the work mentioned, or to H. W. Cox, Ltd.

[808] D. J. B. (Exeter) writes: Will you please help me in the following difficulty? I want to use a photographic handfed arc lamp on the circuit here, which is an alternating one of 100 volts, periodicity 100. The resistance I use gives the right candle-power, but gets so very hot as to be dangerous; but what I want to do is to make a new one with larger wire to get over, as I think, the heating. I have no means of finding out what resistance the present one is. Candle-power required, 400 to 800 c.p. What I should like to know is what resistance must the coil be, and how many amperes must it carry to give me 400 to 800 c.p. with five millimetre carbons. I do not mind the loss that I am told is incurred by using the alternating current as lamp is not used for long periods.

Since you say you have no means of measuring the resistance of your present coil, your best plan will be to take the gauge of the wire now on it (presumably German silver), and make up another coil with wire of twice the section (not twice the diameter), and twice the number of turns. This will give you the same resistance with half the heat. But we fear you will not get a steady light from an arc lamp built for direct current, when fed by one which is alternating. There really is no formula for above, except, of course that the resistance added in circuit must be such as will pull down the

current to the amperage taken by the lamp, that is $\frac{E}{R \times n} = C$, and then that the section of the wire used must be such as will enable it to carry this current without injurious heating. Tables of this carrying capacity of wires may be seen in most wire dealer's lists; if you do not find the one you want, it can be found by dividing when the quotient will be the carrying capacity for German silver.

[882] R. W. (Linslade, Bucks.) writes: (1) What would be the voltage of a P.R. coil wound with No. 22 B.G., containing 61 $\frac{1}{2}$ ozs. of wire and 783 turns? Also of a S.C. coil wound with 8 $\frac{1}{2}$ ozs. No. 32, with 3000 turns if worked, say, by a 3-volt battery. We kindly give the following rule for finding out the voltage of induction coils: (a) In charging a 4-volt accumulator from a 10-volt dynamo, will the use of a graphite rheostat do away with the introduction of an electric lamp in the circuit? Should the positive pole be put to the positive pole of the dynamo, and how can I tell when the accumulator is fully charged?

(1) It is impossible to say the voltage set up either in primary or secondary, unless the current in amperes flowing is also given. The rule is simply this: In the primary, the voltage is equal to the number of turns in the primary wire, multiplied by the number of amperes actually passing through the primary. Say, for the sake of example, that one ampere passes through a coil of 783 turns, the voltage of the "breaker" spark would be 783 volts. Now the voltage set up in the secondary is simply the ratio between the amperes actually passing through the primary multiplied by the number of turns in the secondary, multiplied by the number of turns in the primary, while at the same time the amperage in the secondary is correspondingly decreased. Taking, as before, the amperes passing through primary coil and the number of convolutions in secondary as 3000, the total voltage in secondary would be 3000 multiplied by 783, or 2,349,000, while the current would fall to

$\frac{1}{2,349,000}$ of an ampere. This is the theoretical result. In practice the output would be less, partly owing to loss in converting, partly because of the increasing distance of secondary coils from primary, and partly because of insulation leakage. (2) Provided the resistance of the rheostat can be adjusted to about 10 ohms, the result will be the same. The positive pole of dynamo must be connected to positive pole of accumulator. The best way to know when an accumulator is fully charged is to connect it to a small voltmeter, capable of reading up to about 25 per cent. over the voltage of the accumulator. When fully charged, each cell should register 2.2 volts. Bottone, of Wallington, advertises a cheap voltmeter for this purpose.

[937] J. W. T. (Newcastle-on-Tyne) writes: (1) Could you suggest the best method of ascertaining the number of amperes passing through each arc lamp, working in parallel through one gauge? (2) How do you de-magnetise a watch? (3) Is vaseline a good lubricant for surface of commutator, and, if not, is there a special kind? The reason I ask is that I used vaseline on a commutator of an armature, wound for 300 amperes, 65 volts, and, shortly after applying same, I noticed a long spark on the commutator about an inch from the brushes, and I removed the vaseline at once with a clean rag. Can you explain this?

(1) Take a reading by the ammeter of the total current passing through the whole set of lamps in parallel. Note the number of amperes. Now, if all the lamps are of the same make and candle-power, divide this number by the number of lamps; the quotient will be the amperes taken by each individual lamp. If the lamps are not of the same type and candle-power, take, as before, the total amperage, and switch out the particular lamp, the amperage of which you desire to ascertain. Again take a reading on the ammeter, and subtract the amperes remaining; each cell should register the amperes taken by that particular lamp. (2) By causing it to spin before the poles of a powerful magnet, first quite close to them, and

gradually withdrawing to a distance of two or three yards; after which it should be immediately enclosed in an iron box to protect it from other magnetic influences. (3) Vaseline is not good. Use olive oil; put one drop on the palm of one hand, rub both hands together, and just lay your hands on the commutator.

(67) **Model G.N.R. Express Loco.** A. R. (London, E.C.) writes: I am thinking of building a model G.N.R. Express Loco., and propose to make—bed-plate, 13 in. long; boiler, 8½ in. long, 2½ in. diam. Will you kindly tell me what size driving wheels I should require, and would slide-valve cylinders, ½-in. bore and 1 in. stroke, be the correct size? Also, where castings of wheels and cylinders could be obtained? Would it be possible to use charcoal as fuel?

Driving wheel, 4 in. diam.; cylinders should be ¾ in. bore. To get plenty of steam put five ¼-in. tubes in boiler, and make an internal firebox, with water-space all round. You might get castings from some of the advertisers in the journal. Try Messrs. Martin and Co., East Road, West Ham, E.

(68) **Horizontal Copper Boiler.** J. W. B. (Halifax) writes: Please tell me the bursting and working pressures of a horizontal copper boiler. It is 2 ft. long by 1 ft. diam., and has a single tube running the whole length of boiler, ½ in. diam. Boiler shell is made of 11-16th in. copper plates, single rivetted—rivets ½ in. apart. It is very well made by a large boiler-maker, and was exhibited and got a prize at the Chicago Exhibition. What would be the best method of heating it, and what horse-power could I get from it?

Bursting pressure about 160 lb. per square inch; safe working pressure 20 lb. Either charcoal, m-thylated spirits, or an oil burner would answer. Power about ¼ hp.

For the Book-shelf.

[Any book reviewed under this heading can be obtained from THE MODEL ENGINEER BOOK DEPARTMENT, 6, FARRINGTON AVENUE, London, E.C., by remitting the published price and cost of postage.]

THE SLIDE RULE: A Practical Manual. By CHARLES N. PICKWORTH, Wh.Sc. Fifth edition, revised and enlarged. Manchester: Emmott & Co., Limited, New Bridge Street, and C. N. Pickworth, Fallowfield. Limp cover. Price 2s.

The fact of a book of this kind having gone through four editions in as many years, is in itself a proof that its presence is needed. The good opinion thus set up is borne out by an examination of the contents. The type of slide rule especially dealt with is the Gravet or Mannheim, one of the most recent and reliable of the many varieties of this instrument. As the author rightly remarks, it cannot be denied that a fairly useful knowledge of the slide rule can be learned by rote, but no one using the rule can possibly take an intelligent interest in manipulating it without an elementary knowledge of logarithms, and cannot therefore use it to the best advantage. The explanations and theoretic instructions in this little manual are exceedingly clear, and the numerous examples set are carefully arranged so that there should be no difficulty in following the reasoning, and no fear of getting into deep waters.

With a view of getting rid of the cord system of communication between passengers, guards, and drivers, the North Eastern Railway Company has been making some experiments to enable passengers to apply the continuous brake to a train in cases of emergency. "Mr. Worsdell, the locomotive superintendent," says the *Mechanical World*, "is the inventor of the apparatus, which is worked by a lever in each compartment. This, when pushed up, releases the air in the Westinghouse brake pipe, and thus brings the brake into action, at the same time causing a whistle under the carriage to blow until the guard, by means of a key, restores the handle of the lever to its normal position. The guard is in this way able at once to locate the compartment in which the passenger who has made use of the apparatus is travelling. The appliance can also be used in connection with the automatic vacuum brake."

Amateurs' Supplies.

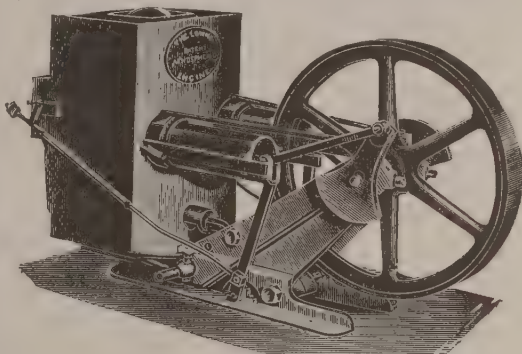
[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.]

The Universal Electric Supply Company.

We have received for examination some samples of the electrical goods supplied by the Universal Electric Supply Company, 47, Crosscliffe Street, Moss Side, Manchester. These include a complete set of parts for making up a "Hercules" shocking coil, an "Acme" bell set, and a special "Universal" lamp holder for bottom-loop lamps. Considering the low prices asked for these goods the quality is commendable. The bell in the above set is a well-finished production, neat enough to satisfy the most fastidious taste, and the whole set, which includes battery, wire, and push, is accompanied by clear instructions so that no knowledge of electricity is necessary for successful fitting up. The "Hercules" set of coil parts should also make up into a useful piece of apparatus. We have tested the coil with a couple of dry cells, in a rough and ready manner, and find it sufficiently capable of providing a source of amusement. All the necessary parts, including base board, handles, terminals, and contact brackets are provided, together with instructions. The lampholder submitted is a useful little thing which is a necessary adjunct to small incandescent lamps, and it is cheapness itself. Prices and particulars of the above, together with other electrical sundries, can be had free on application to the Universal Electric Supply Company.

R. M. Lowne.

We have received descriptive lists of Messrs. R. M. Lowne's Patent Atmospheric Engine. This engine is described as a "vacuum," not hot air. A small size model was exhibited some time ago at a meet-



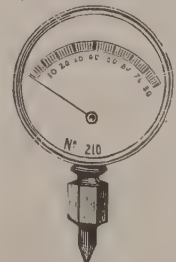
ing of the Society of Model Engineers and attracted much attention. It is claimed that its good points include instantaneous starting, absence of any danger, speed under perfect control, and that it is inexpensive to work. The engine is started by lighting a gas jet, when the engine will at once start—no heating up of any sort being required. Readers may get particulars and prices on application to R. M. Lowne, Ravenscroft, Catford, London, S.E.

New Lines in Model Fittings.

When making a call a few days ago at Steven's Model Dockyard, 22, Aldgate, London, E., we took the opportunity of inspecting some new lines for model engineers which this old-established firm are now handling.

"The Champion" Model Bourdon Pressure Gauges, one of which is shown in the accompanying illustration, are likely to go well by reason of their very low price and the general neatness of their appearance and finish. They are made in six sizes from 1 in. up to 3 in. in diameter, and register up to from 45 lb. to 150 lb. pressure according to size. The prices range from 5s. 6d. to 10s. 6d. each, and it should be noted that the gauges are fitted with union and connecting pipe, and are guaranteed for twelve months. We were also shown some new patterns in boiler taps, these being extremely well turned out and a great improvement in appearance over the old styles. Messrs.

Stevens are now making a special feature of supplying parts for model locomotives, such as funnels, spring buffers, domes, bogie-



carriage frames, reversing gears, full particulars of which will be found in the firm's new list which is in active preparation. We understand that the new list will quite eclipse anything which the firm has previously issued, and will be ready in the course of another month or so.

Messrs. F. & H. Shaw, Ltd., of Hebden Bridge, write us that their firm has been incorporated under the Companies' Acts of 1862-1898, dating from the 16th of March. The capital is £10,000 in £5 shares. Although they are branching out into much larger work, they desire to assure their former customers that the small list will have better attention than hitherto, and that no order will be too small for the firm to undertake.

Catalogues Received.

The Universal Electric Supply Company, 47, Crosscliffe Street, Moss Side, Manchester.—This is a very well-filled list of electrical goods of all descriptions, although the firm by no means regards it as a complete list of the goods they are prepared to supply. Many prices have been reduced from former quotations, so that all who require an up-to-date electrical list should write as above, mentioning *THE MODEL ENGINEER*, when this list will be sent post free.

Albert E. Oakley, 569, Green Lanes, London, N.—This is a list of small accumulators and lamps. The latter are very carefully standardized so that a customer can order a lamp to suit his requirements and be always sure of getting a similar lamp at any later date. We understand that Mr. Oakley is putting down a lighting and charging plant so as to be able to charge any size and number of accumulators at very cheap rates. Lists will be sent on receipt of one penny stamp to cover postage.

T. C. Wilson & Co., Lion Plate and Cutlery Works, Sheffield.—A new catalogue, full of illustrations, reaches us from this firm. Hundreds of new designs in electroplate, silver, and cutlery, are here given, making a very attractive and well-arranged list, which those of our readers, who are on the look out for good and suitable presents for their friends, should not fail to obtain. The secretaries of model-yacht clubs will also find this a useful catalogue when deciding on the purchase of prizes. List will be sent, post free, to any reader mentioning this journal.

C. L. Ford, 55, Market Street, Stalybridge.—We have received from this firm a new list of small accumulators, micro-battery lamps, electric jewellery, water motors, &c. These appear to be fully up to standard. A speciality is made of "non-spillable valves," which are fitted to the accumulators at a slight extra charge. A second list gives particulars of acetylene cycle lamps and generators, and also a line of overtype dynamos. Either list will be sent on receipt of one penny stamp.

Friswell, Limited, 8, New Bridge Street, London, E.C.—Messrs. Friswell send a catalogue of cycle accessories, which has been brought up to date. Readers requiring new fittings to their cycles should write for this list without delay.

A. and J. Smith, 23, and 25, St. Nicholas Street, Aberdeen.—A large number of our readers are photographic enthusiasts, and these should send a stamp for Messrs. A. and J. Smith's catalogue of cameras, lenses, and photographic materials. There is a plentiful choice of hand and stand cameras, tripods and sundries to select from, everything being plainly tabulated and priced.

C. Nurse & Co., 182, and 184, Walworth Road, London, S.E.—A new enlarged edition of this well-known firm's illustrated price list is to hand, and is full of interesting matter for the wood or metal worker. The catalogue runs to more than 200 pages with some hundreds of illustrations for every kind of work. Says Messrs. Nurse's specialist may be said to be plans of what a quiet, bewildering variety is listed, suited to all purposes. Other items, however, are well in evidence, and the inclusion of several new articles makes this altogether one of the most comprehensive catalogues in its line. Many sets of drawing instruments find a place in these pages, as well as artists' material of many kinds. Our readers who want to know where to get their tools and what to pay for them, can hardly do better than request the price of this catalogue, mentioning *THE MODEL ENGINEER* when they do so.

Henry Milnes, Ingleby Works, Bradford.—One of the best lathe catalogues we have seen, with excellent illustrations printed on a pure white paper, is that sent us by Messrs. Milnes. In it will be found a large variety of lathes, machine tools, and accessories, all carefully indexed and the prices fully set out. Castings and forgings of these high-class machines and tools are supplied by Messrs. Milnes, and this comprehensive catalogue gives the particulars of the widest variety of tools coming under that head. We note it has been again revised and brought up to date. It would be impossible to give any definite list of the contents; it must suffice to say that

R. Melhuish, Sons & Co., 84, 85, and 87, Fetter Lane, Holborn Circus, London, E.C.—This is a well arranged cloth-bound catalogue of engineers' tools, machinery, &c., of more than 300 pages. Everything requisite for an engineer's machine shop is supplied by Messrs. Melhuish, and this comprehensive catalogue gives the particulars of the widest variety of tools coming under that head. We note it has been again revised and brought up to date. It would be impossible to give any definite list of the contents; it must suffice to say that

the list contains a very large selection of the latest patterns in stocks and dies, cutters, general machine shop and special precision tools, lathes, drilling and milling machines, and other apparatus incidental to all grades of engineering and for electricians. The price of this section is 2s. 6d., which, however, will be allowed on the first order amounting to 60s. or more.

Archibald J. Wright, 218, Upper Street, London, N.—Those of our readers who intend to invest in an acetylene bicycle lamp, should communicate with the above firm, who have sent us a price list of this line of goods. It is claimed that these are selected lamps well-finished, and of good value for money. The list will be sent to any reader sending a penny stamp.

The Endurance Motor Company, Limited, Gosford Street, Coventry.—The many readers of *THE MODEL ENGINEER* who are thinking of making a small oil motor for driving a cycle or light motor car, or for a river launch, will find this company's list of interest. It contains illustrations and particulars of several patterns of such motors of varying sizes, and also full lists of prices, not only of the finished engines but also of sets of plain or partly machined parts. It may be had, post free, on application by mentioning this paper.

J. W. Barnard, 4, Great Winchester Street, London, E.C.—Probably most of our readers are aware that Mr. J. W. Barnard is the sole agent for the small accumulators manufactured by the well-known E. P. S. Company, Limited. In the latest list which we have received, we find particulars of the various sizes of "Q" and "V" type cells, the former ranging from 7 to 70 ampere-hours capacity, and the latter from 16 to 32 ampere-hours. Mr. Barnard has recently opened a branch at 13, Brownlow Street, Holborn, W.C., for re-charging and repair work, but applications for lists and all correspondence should be addressed to him at Winchester House.

We hear that an electric organ on the Hope-Jones system has been installed in St. Michael's, Chester Square. The pedal, great swell, solo, and choir organs stand in the chamber occupied by the old organ, at the south-east of the chancel. The echo organ is bracketed on to the wall at the western end of the south side. The organ is blown by three hydraulic engines. The console or key desk is movable, and would permit of the organist being seated in almost any part of the church, if desired. By means of electricity the music is flashed to the answering organ through 100 ft. of flexible electric cable, containing 2,040 fine insulated wires. The action is so rapid that it would "repeat," if necessary, upwards of sixty times per second. The keys are furnished with "double touch," so that the organist may obtain greater power of tone by increased pressure of the finger. An additional row of keys is provided for governing the "stops." These "stop keys," as they are termed, take the place of the usual draw stop-handles.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 3s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to *THE EDITOR*, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All correspondence relating to advertisements to be addressed to the ADVERTISEMENT MANAGER, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All subscriptions and correspondence relating to sales of the paper to be addressed to the publishers, Dawbarn & Ward, Limited, 6, Farringdon Avenue, London, E.C.

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VOL. II. No. 18.

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A Medical Coil and How to Make It.

A MEDICAL or shocking coil is a useful bit of apparatus to possess, easy to make, and you can make a better coil at a cost of ten shillings than can be bought for three times that sum; not so handsome, perhaps, but very effective and powerful. The model which I have, with one or two little modifications, adopted, is that suggested by Mr. Bottone, and is figured below, not quite complete though, for I purpose fitting it with a rack and pinion movement for the better and easier regulation of the secondary coil.



FIG. 1.—THE FINISHED COIL.

Another advantage in this form is that each part is visible; as a matter of fact, the coil takes to pieces, and thus each part may be, if necessary, described in detail for educational purposes.

The first thing to do is to make the core. This is formed of a bundle of straight iron wires, No. 18 gauge. Procure a hank of the softest iron wire; then cut into lengths of about $4\frac{1}{2}$ ins., and make as straight as possible; now get a piece of thin brass tubing about $4\frac{1}{2}$ ins. in length by $\frac{1}{2}$ in. diameter. (This tube, a small break and hammer-head, and the wires, say $\frac{1}{2}$ lb. No. 20 or 22 single cotton-covered wire, and the same weight of No. 36 single silk wire, had better be bought direct of some dealer in electrical stores.) Fill this brass tube with the iron wires, pack tightly, then having drawn an inch or so at a time, bind the wires with wire securely twisted round; file the ends up straight, and having dipped them in "killed" spirits of salts, dip them in

molten solder, clean up, wash in hot water, dry, and finally soak to saturation in hot paraffin wax; the result should be a core of wires, over which the brass "regulating" tube will just easily slide.

Make a paper tube, 4 ins. in length, as follows:—Roll a piece of white demy round the brass tube; cut a piece of tough brown paper, 12 ins. by 4 ins.; give this a coat of thin hot glue, and roll it tightly round the papered tube; when quite dry and hard draw out the brass tube, and having squared or trued up the paper tube, give the latter a soak in hot paraffin wax.

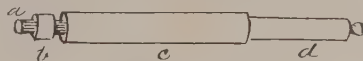


FIG. 2.

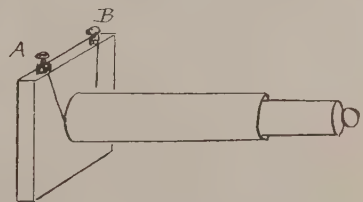


FIG. 3.

Now take the core and form a paper collar half-an-inch from one end and about half-an-inch in width, by rolling and glueing a strip of brown paper round at this point. This collar must be just thick enough to take the paper tube just made (it can, of course, if too thick be easily filed down). When dry, give it a coat of glue and slide on or fit it into the paper tube. The brass tube may be left in position during this little operation, and while the joint is drying. See Fig. 2, where *a* is the core, *b* the collar, *c* the paper tube, and *d* the brass tube.

Cut out of mahogany or teak, $\frac{3}{4}$ inch thick, a 3-inch square; bore a hole in the centre of this to exactly take the paper tube just made and fitted. The end of this tube, with the protruding core, must be then securely glued into the aperture, taking care to fix the tube squarely and at right angles. (See Fig. 3.) When this is dry, put in a couple of terminals as shown, A and B (Fig. 3), and having bared one end of the cotton-

covered wire turn it round and under the terminal at A, and proceed to wind on the (primary) wire in tight, even coils nearly to the end of tube; tie down here; baste the layer with hot melted paraffin wax; put on a layer of wax paper; then recommence winding; put on four layers, waxing each in turn as described, finishing up by baring the finishing end and inserting under terminal at B; give the last layer a basting with hot wax, and roll it up smooth and straight as possible in the fingers. Our primary is now complete, and may be mounted on a polished baseboard, 12 ins. by 4 ins. or so, by means of a couple of screws put in from underneath.

We must now make the secondary bobbins. Provide two wood ends, mahogany or teak, $\frac{1}{4}$ -in. thick, but shaped as shown in Fig. 4. Roughly, they may be 3 ins. square, plus the stud at the bottom which is to secure it to the rebated guide strips, afterwards to be fixed to the baseboard.

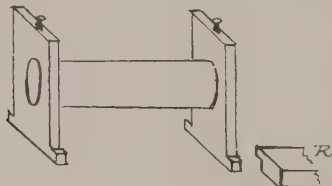


FIG. 4.

Make or procure a thin paper tube, 4 ins. in length, and of diameter large enough to just smoothly slide over the primary, and having given it a soaking in hot wax, mount this centrally between the two wooden ends just referred to. This must be carefully done, and, in fact, all the necessary fitting of the bobbin should be completed before commencing to wind on the wire. Two fillets of wood rebated as shown at R (Fig. 4) are, therefore, glued or screwed to the baseboard, and the finished bobbins adjusted to slide easily between them.

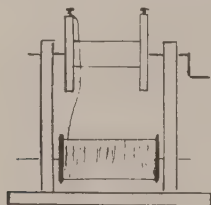


FIG. 5.

Before starting to wind the bobbin, we must make a winder (see Fig. 5); this is formed out of a square of pine or other wood, 8 ins. by 6 ins., with two uprights; the reel of wire and empty bobbin being arranged as shown. The wire should receive a preliminary coating of wax, which is best done by soaking for some minutes in hot paraffin wax, and draining; it should also be tested for continuity by means of a small battery and galvanometer. Having bared one end of the wire (No. 36 silk covered), pass it round the screw of a terminal as shown, and commence to wind, the turns of wire must be drawn tight and close together; in this way the first and succeeding layers must be put on; each layer is also to be basted with hot melted paraffin wax, and receive one layer of thin waxed paper; the wire is thus put on in one continuous length, going from end to end and backwards and forwards in close, even turns, finishing at the opposite

terminal to which we started, and here the end is bared and connected.

It is most important to avoid all breaks and flaws, and kinks or knots in the wire; therefore, at the least suspicious part the wire should be cut, the ends bared and twisted together, and a fresh joint made with resin and

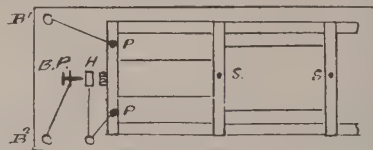


FIG. 6.

solder, the joint then being made good with a little twist silk and wax, and, of course, at such times the wire should be tested for continuity. The bobbins may be "finished" by covering with velvet, or thin sheet ebonite; the wooden parts, ends and base, will also be polished or varnished to suit the worker's fancy or pleasure.

The contact breaker for this little instrument can be bought ready made, with platinum contacts complete; the height required will be $1\frac{1}{2}$ ins.; the requisite holes for these are bored in the base and the parts secured by nuts underneath. If thought proper, the primary wires may also be brought down through the base. Supposing Fig. 6 to be a ground plan of the coil, one of the battery (two bichromate cells) wires is connected to B¹, the other to B², the current will pass through the primary (the other end of which is connected with the break hammer); the core being thus magnetised, draws the hammer head towards it, the effect of which is to break contact with the platinum point at B P. The electric circuit being thus interrupted, the de-magnetised core no longer attracts the hammer, which, being released, makes contact once more with the point at B P, the make and break being repeated as long as a current is available.

We now require two handles, and these, in their simplest form, may consist of two pieces of brass tube, two lengths of flexible wire cord being also provided. One end of each wire is soldered to a tube or attached by means of a screw, the other (terminating in a short piece of stout copper wire) for insertion at S and S respectively. With a coil made as above a battery of two bichromate cells will be found quite sufficient for the purpose.

[Note.—We are indebted to the Editor of the *British and Colonial Druggist* for permission to publish the above description and illustrations.—E.D. M.E.]

The Brush Electrical Engineering Company, Limited, of Queen Victoria Street, and Loughborough, Leicester, manufacture a high-speed enclosed type steam engine known as the "Universal." A description of this engine, with admirable illustrations, has been published by the firm in the form of a little booklet, which is bound to attract the attention of high-speed engine users. Printed on fine glazed paper, with the neatest type, everything has been done to make the working arrangements as clear as possible, and the result is an eminently interesting book. The Universal steam engine is double-acting, and has few working parts. It is designed for electric light work, and it is claimed that the engine runs smoothly and quietly, and with great economy of steam. Although enclosed when working, the removal of a steel casing at once renders the engine as accessible as any open engine.

The Society of Model Engineers.

THE usual monthly meeting of the Society of Model Engineers was held at the Leopold Rooms, 3, St. Bride Street, E.C., on Monday, May 8th, about forty members and friends being present. The following exhibits were shown by the members:

Mr. Bryant had an excellent model G.N.R. coal truck, correctly painted and lettered.

Mr. J. C. Taylor exhibited a model loco with cylinders $\frac{3}{4}$ -in. bore by $1\frac{1}{2}$ ins. stroke, but the boiler of which could not be made to steam properly. Several suggestions were made in order to overcome this defect.

Mr. E. L. Pearce showed a model of an American freight truck on two bogie carriages, enabling it to negotiate the sharpest curves.

Mr. J. C. Crebbin contributed a tiny loco, which he stated was the favourite model of his late brother, Mr. E. J. Crebbin. The little engine had run for a minute-and-a-half at the rate of $4\frac{3}{4}$ miles per hour.

Another fine-looking engine was a model to $\frac{3}{4}$ -in. scale of the Achilles class, G.W.R., lent by Mr. F. Moore.

The inspection of the various models having taken some time, the chair was taken by Mr. PERCIVAL MARSHALL at 7.45, and formal business proceeded with. Several new members were enrolled. Before proceeding with the discussion, Mr. Bryant passed round for examination some useful home-made tools, including a toolholder made to take portions of broken hack-saw blades for use as parting tools in the lathe, which we describe elsewhere; some slot-drills, and a drill for drilling and countersinking at one operation.

Mr. CREBBIN then opened a discussion on the question of permanent way for model loco tracks, and was followed by

Mr. W. Blaney, who produced a drawing and small model of a permanent way track, which he proposed should be erected in the room where the S.M.E. meetings were held for the purpose of trials of locos under steam. The suggestion met with much applause, it being the evident desire of the members that such an arrangement should be carried out. Various types of permanent way, rails, &c., were exhibited and described by Messrs. J. C. Crebbin, J. C. Taylor, E. L. Pearce, and A. M. H. Solomon; and several other members contributed to an interesting and practical discussion. A sample of track, with brass rails, was also shown by Mr. H. O. Drake.

The debate being finished, a question was asked by Mr. J. C. Taylor as to the best enamel for model engines. The verdict was unanimously in favour of Maurice's Porcelaine, the engine being "stoved" after painting by leaving it overnight in a warm oven.

A printed list of members of the society is now in course of preparation for early issue. The secretary would be glad if all members would drop him a post-card, mention the subject in which they are specially interested, and also requests intending members who wish to be included in the list to send in their applications at once.

THE NEXT MEETING.

The next meeting of the society will be held on Tuesday, June 6th, at seven o'clock, at the Leopold Rooms, 3, St. Bride Street, E.C. In order to encourage members, to take a more active part in the proceedings of the evening, the committee have decided to offer a prize on this occasion for the best verbal description of a home-made workshop appliance. The prize will consist of a book or books to the value of 5s., published price, which may be selected by the successful competitor, and the award will be made by general vote of the members present.

The following meeting of the society will be held on Wednesday, July 5th.

THE LIBRARY.

The following additions have recently been made to the library, viz.: "Screws and Screw-making," presented by the Britannia Company, Colchester; and "Engine and Machine Details," by Wallace Bentley, presented by Mr. J. C. Crebbin.

PROVINCIAL BRANCHES.

THE BRADFORD BRANCH.—The monthly meeting of this branch was held on Monday, May 8th, when there was a good attendance, several new members being enrolled. A model under-type dynamo, made by Mr. T. H. Wilson, was shown by him for a second time for the benefit of the new members. The next meeting will be held on Monday, June 5th, at 7 p.m., in Tyrrell Street Coffee Tavern, Bradford, when Mr. Wilson will read a paper on "Small Tools." All interested in model making will be heartily welcomed. Mr. John Hey having resigned the office of secretary, Mr. James H. Lamb was duly elected for that office. All communications for the above branch should, in future, be sent to Mr. James H. Lamb, Holly Bank, 109, Rushton Road, Thornbury, Bradford, Yorks.

For the Book-shelf.

[Any book reviewed under this heading can be obtained from THE MODEL ENGINEER Book Department, 6, Farringdon Avenue, London, E.C., by remitting the published price and cost of postage.]

THE OPTICAL LANTERN. By ANDREW PRINGLE, F.R.M.S., F.R.P.S. Third edition. London: Hampton & Co., 13, Cursitor Street, E.C. Price 2s. 6d., cloth bound.

It is only to be expected that a book on the optical lantern by so well-known an authority as Mr. Andrew Pringle should enjoy a considerable measure of favour with those interested in this subject, and this view is fully borne out by the fact that the publishers have found it necessary to bring out a third edition of the work. In the twenty-one chapters which this book contains, the whole theory and use of the optical or magic lantern are fully dealt with, the various forms and constructive features usually adopted being clearly explained and illustrated. Much useful information is also given on the subjects of illuminants, storage of compressed gases, the electric light, experimental apparatus, preparation of lectures, practical working and management of lanterns during use, enlarging, &c. The present edition has been brought fully up-to-date, as may be gathered from the fact that it contains a complete chapter on animated photography and projection, and also illustrations and descriptions of acetylene generators and lantern jets. The book is well printed on good paper and neatly bound in cloth. It may be heartily commended to all lantern-users.

BRITISH PATENT LAW, AND PATENTEE'S WRONGS AND RIGHTS. By HUBERT HAES. London: W. B. Whittingham & Co., Ltd., 91, Gracechurch Street, E.C. Post free, 1s. 4d.

A sage once remarked "the law's a hass," but the expressive individual who originated this oft-quoted saying would probably be puzzled to select a member of the animal world whose stupidity would equal that of what is termed patent law. Mr. Haes has in this little book set himself the task of explaining the rights and wrongs of British patentees, and judging from the thoroughness with which the subject is investigated, and the forcible style in which the injustice done by the existing system is laid bare, the author has found his work congenial. The volume will form instructive reading for both actual and prospective patentees, and should be of especial interest to those who have the subject of patent-law reform at heart.

A Model Steam Hammer, and How to Make It.

By F. E. P.

THERE can be no doubt that many an ardent amateur mechanic, who has succeeded in the ordinary lines of model engines and boilers, has felt dissatisfied at the limitations put upon him by the majority of writers and the modelling trade in general. Considering that the field of practical engineering is to day so very widespread, and the number of amateurs who take an intelligent interest in all its branches so very consider-

of its original—is of very little use indeed. Modifications are necessary if the machine is to stand the strain of continued working; these modifications being generally easy to define. Roughly speaking, details such as bolts, small hand levers, and other delicate parts must be strengthened; and it is due to these slight alterations that some differences have sometimes to be made in the general outline.

In the subject of the present article—a working steam-hammer model—the design has been kept so closely to the general lines adopted in actual machines, that the finished hammer may be expected to look thoroughly workmanlike and effective. Owing to the massiveness of steam-hammer design, also, there is less need to make

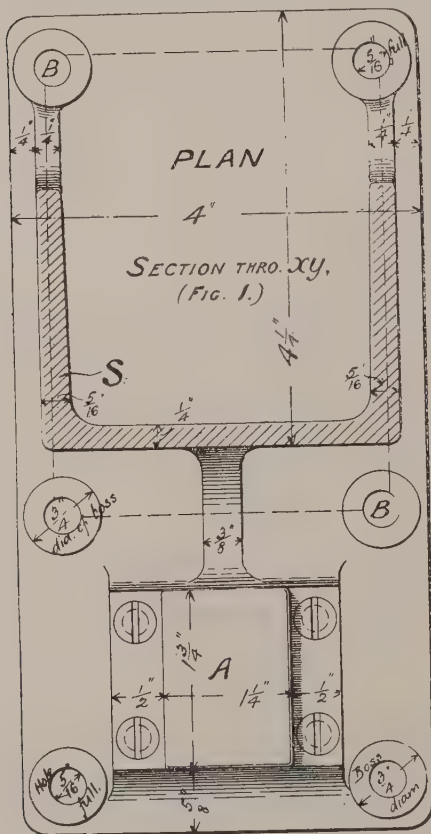


Fig. 3

able, it is a matter of wonder that information suitable to their needs is so scarce. This article is expressly written to supply such a need. The model described is not merely a model in looks only, but will work and stand ordinarily rough usage. It must be borne in mind that for practical purposes a model which is precisely accurate in every minute detail—a perfectly faithful copy

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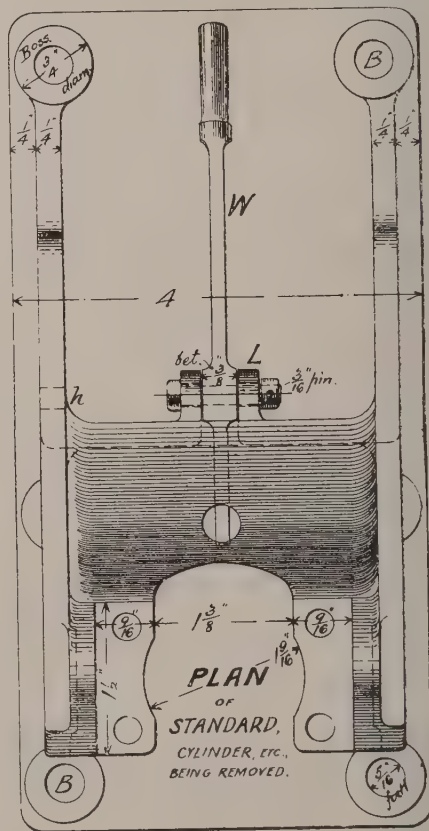


Fig. 4

the various details of greater strength in this reproduction. A type of single-standard hammer has been chosen for copy, as presenting less difficulty and being more manageable than the larger double-standard pattern. In the present article, general information only on the construction will be given, description of the details being held over till the next issue.

The design illustrated has two main parts—the stan-

dard (S) with anvil, and the cylinder (C) with its slide-valve and piston. Taking the standard first, it is complete in one casting, the anvil being faced with a steel top to prevent undue wear. This casting (which is of iron) certainly presents the most formidable difficulty to the amateur maker, although comparatively simple to mould. There is no great amount of machining or filing to be done to the rough casting, the principal places being the cylinder bearing surfaces, the slide-bar surfaces, and the anvil-top (A). On all these surfaces sufficient metal (from 1-16th in. to 1-8th in.) must be left for working upon, and such places as the bosses for holding down bolts (B, B) should be cast a little thick to allow for "cleaning up." The under surface of the whole standard should, of course, be planed if possible, a good bearing being important to stand the blows of the hammer. Two lugs will be seen at L, L, one on each side of a hole cored in the casting. These lugs carry the fulcrum-pin for the working lever. They have to be drilled with holes 3-16th in. full diameter, and as it would be impossible to do this owing to their position between the sides of the standard, the drill has first to go through one of these sides, as shown at *k* (Figs. 2 and 4). The dotted lines shown in the base in Figs. 1 and 3 indicate a recess $\frac{1}{4}$ in. deep made under the standard, in order to minimise the amount of labour required to machine the bottom. Obviously this recess could not be allowed under the anvil, where a firm bearing is essential. A departure from the real design is made in having in one casting the anvil and hammer standard, but the present design is of ample strength to guard against any danger of breakage on this account. The main portion of the standard, as will be seen by reference to Fig. 3, is of a section forming three sides of a square. The two wings and the front are all $\frac{1}{4}$ in. thick, the sides being a little thicker towards their junction with the front to make the moulding easier.

The cylinder (C) has many points of difference as compared with the ordinary steam engine pattern. The first is its great length in proportion to diameter. In this instance the full stroke would be 3 in. and diameter $1\frac{1}{4}$ in. As it is necessary to allow the hammer-head to strike the anvil before the piston reaches the lower cylinder cover, the effective stroke is reduced to $2\frac{3}{4}$ in., to prevent any fouling. Another point of difference is in the piston-rod and piston. The former is of large diameter, for several reasons. In the first place, great stiffness is required, and weight is a desirable object; and secondly, a large diameter of piston rod reduces the quantity of steam used for lifting, as against the amount allowed for driving the hammer. Similarly the piston is made solid, and of great depth.

The slide-valve in the model is of the ordinary steam-engine type, instead of that usually in use on steam-hammers, which would require too complicated a casting. The valve is worked by the valve-rod (*r*, Fig. 1), and working lever (W), which latter has a slot in the valve-rod end to allow sufficient play for the valve-rod pin.

The best results will be obtained with a high pressure of steam. The details which will be given will be strong enough in every particular; and, although it may be worked with 10 lbs., a pressure of 30 lbs. on the square inch will make the hammer a "working" model in the real sense of the words.

A new monthly journal, devoted to matters connected with fire extinction, has appeared, and is now in its third month. This journal is *The Thermstat*, and it is a well-printed publication on excellent paper. An important feature is made of the fires occurring in each month, which are fully reported and commented upon. Those interested in fire prevention and extinction will find *The Thermstat* a very good pennyworth.

A Model Railway Truck.

By F. J. BURNHAM.

THE accompanying photograph shows a model truck which I made about three years ago, and which has lately been re-painted and fitted with a hand brake. The gauge is 4 ins., and the underframe is built up of mahogany, the main parts being $\frac{3}{4}$ in. square. The rest of the woodwork was cut out of teak, $\frac{3}{8}$ in. thick. It will be noticed by the photograph that the truck is fitted with side doors similar to ordinary waggons, and secured, when not open, by bolts as shown. The wheels are cast iron, $3\frac{1}{4}$ ins. diameter, and 7-16ths in. on tread, and the axles (cast steel) are $\frac{3}{8}$ in. diameter and 5-16ths in. on the journal. The hornplates were cast in brass, with horn blocks for the axle boxes to slide in, and were attached to the inside and underside of the side frames. This necessitated a horizontal ledge to be cast on the hornplate, which was webbed on the underside for strength. I considered that this was necessary, considering the rough usage the truck is put to. In my opinion ordinary flat hornplates for models are not strong enough, as they are liable to bend outward in use. The



axle boxes are somewhat similar to those described in No. 1 of *THE MODEL ENGINEER*, so no further description is necessary.

The springs (bow) were the most difficult task, and the one most likely to baffle an amateur. They consist of strips of hard brass, No. 22 B.W.G., cut into suitable lengths and hammered up to the required curves, care being taken not to hammer more on one side than on the other, as it causes the plate to bend sideways, which is difficult to rectify.

The buffers are the modern type, as used on railway coaches, &c., but are self-contained. The springs are inside the boxes, and the plungers kept from coming out of their places by collars screwed on the spindles, which bear against the springs when forced in.

The draw bars have also springs around them, which lessen shocks when starting. The brake gear is similar to that in use on ordinary waggons.

For further particulars I must refer the reader to the photo or to myself, as I shall be pleased to furnish him with any further information.

This model was exhibited at one of the recent meetings of the Society of Model Engineers.

[If any reader wishes to communicate with Mr. Burnham we shall be pleased to forward letters if addressed to the Editor. A stamped addressed envelope for the reply should be enclosed.]

How to Centre Work for the Lathe.

By "ATLAS."

ALTHOUGH the operation of preparing a piece of iron or steel, or other metal, for running properly between the lathe centres is a very simple one, there are probably many readers of these pages who do not know the right way to go about it, or who do not appreciate its importance in relation to the quality of the turning afterwards done on the particular piece of work in hand. Many inexperienced lathe users, when centering up a piece of work, simply smooth up the end with a file and make a "centre-pop" with a hammer and centre-punch as near the middle of each end as they can guess. This method of procedure may give rise to one or more of the following troubles when the job is being turned:—

(1) The work may be a good deal out of truth when first

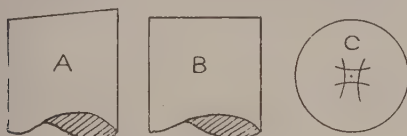


FIG. 1.

starting turning, which makes the first cut very uneven in character, or prevents the work from cleaning up to the proper diameter; (2) the work may run out of truth after being partially turned; (3) the work may not run true when changed end for end between centres; (4) the turned portions may be oval, instead of being truly round.

The first of these troubles is obviously due to the "centre-pop" being incorrectly placed; the second will be due to the fact that the point of the lathe centre rests at the bottom of the "centre-pop," and is not supported at the sides, thus not having a proper bearing and, consequently, being able to shift about as the cutting pressure

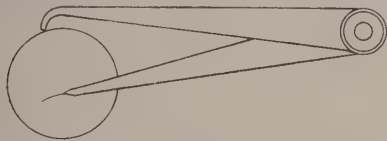


FIG. 2.

is applied; the third trouble will assuredly arise if the "centre-pop" at the poppet-head end wears as above suggested; while, if the fourth trouble prevails, the cause will probably be found in the fact that the end of the work has not been filed at right angles to the axis before centering up, thus causing the lathe centre to have more bearing on one side than the other. Of course, for many light and unimportant jobs a simple "centre-pop" in the end of the work will answer very well if carefully and correctly placed; but for all work of any size, or where accuracy is desired, the following method should be adopted:

I will imagine the reader about to centre a round piece of metal which has just been cut off a long bar. The first thing is to file both ends practically square, as at B in Fig. 1; on no account should they be left as at A. Then fix the job end up in the vice, and rub the top end over with a piece of chalk. Take a pair of "hermaphrodite" or "odd-leg" calipers, as they are usually called, and open them to approximately half the diameter of the

rod to be centred. Then from four sides mark curved lines round the centre of the work, as shown in Fig. 1, keeping the end of the curved caliper leg in close contact with the circumference of the work while each line is being marked as shown in Fig. 2. The small space enclosed by the lines thus drawn will be the correct place

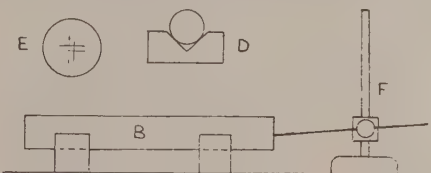


FIG. 3.

for the "centre-pop," which should then be made. The opposite end of the job must next be treated in the same way.

An alternative method of marking out the centre of a round rod is shown in Fig. 3. The ends of the rod are first filed square and chalked as previously described. The rod B is then laid in the grooves of a pair of vee-blocks,

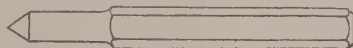


FIG. 4.

which are placed on the lathe-bed or other perfectly flat surface. A scribing block or surface-gauge F is then brought into use, the scribe being set with its point approximately level with the centre of the rod. A horizontal line is scribbled or marked across each end of the rod. This done, the rod is given a quarter-of-a-turn and another line marked; again a quarter-of-a-turn and then another line; and finally another quarter-of-a-turn and another line marked. The point where these lines intersect, as at E, shows where the centre-pops should be placed.

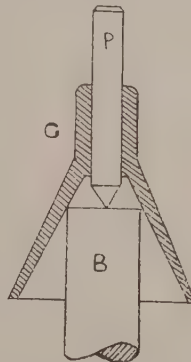


FIG. 5.

A useful form of centre-punch is shown in Fig. 4. The body is made hexagon or octagon in shape to prevent it rolling off the bench, while the top being slightly bevelled, obviates an unpleasant burr being produced by the frequent hammering it receives. The point of the centre-punch should be ground as nearly as possible to the same angle as the lathe centres, and should be hardened and tempered to a deep straw colour.

In Fig. 5 is shown a device very frequently used in engineers' workshops, known as a "bell" centre punch.

This tool consists of a cone-shaped cup with a boss at the upper end in which a centre-punch slides an easy fit. With this appliance there is no necessity to mark out the centre of the work, for when the cup is placed over the end of the work to be centred, it automatically brings the punch over the exact spot required.

The work having been roughly centred up by one of the foregoing methods, it should be placed rather loosely between the centres without a carrier, and lightly spun round by the fingers. It will at once be apparent whether the centering has been correctly done or not. If the work runs out of truth, a piece of chalk should be held close to it while it is being spun round, so as to touch the side which runs farthest out from the centre. The work should then be fixed again in the vice and the centre-pop drawn over by careful use of the centre punch towards the side marked by the chalk. The work should again be placed in the lathe and the process repeated until the desired accuracy is obtained. If, however, the centre has been carefully marked out with the calipers or scribing block as already indicated, it will need little or no correction in this way.



FIG. 6.

In rapidly and accurately centering a number of pieces of work the "square-centre" is of much service. This is an ordinary lathe centre with four flats filed on the point, so as to form cutting edges (Fig. 6). It is used as follows. The work after being roughly centred with a punch, the marking out process not being necessary, is fitted with a carrier and placed between centres, the ordinary back-centre of the lathe being replaced by the square centre. A square ended bar (H) the shank end of a tool will do if fairly smooth, is fixed in the slide rest, or held very firmly against the hand rest, and is then gradually brought to bear against the work, while the latter (B) is running round as in Fig. 7. At the same time the square centre is fed up against the end of the work,

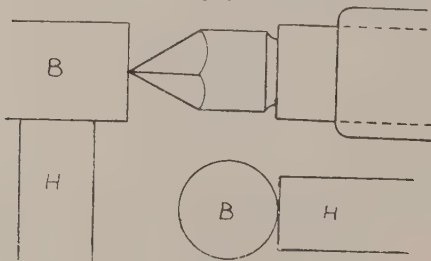


FIG. 7.

and as the latter is being forced to run true by the pressure of the bar in the slide rest, a correct centre-hole is cut. Some workers prefer to use a fork-ended bar to press against the work as keeping it under better control, though with ordinary care the plain end is quite sufficient. Although a square centre is frequently of much service in work of this kind, it is by no means indispensable to the amateur.

The work having once been correctly centred, the next process is to drill at each centre-pop a small hole about 1-16th in. diameter, as shown in Fig. 8. This hole should be larger or smaller than the size mentioned according as the work is very large or very small, and should not be drilled more than $\frac{1}{4}$ in. deep, though

3-16ths in. or $\frac{1}{2}$ in. will be found sufficient for light jobs. The object of this hole is to allow the centre point of the lathe centre to clear at the bottom. Following this, each of these holes should be countersunk to the exact angle of the lathe centres, as shown in Fig. 9. The best way



FIG. 8.

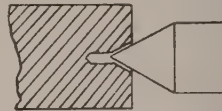


FIG. 9.

to do this is by means of a countersunk centre-bit to fit in the lathe mandrel, as shown in Fig. 10. It is simply an ordinary lathe centre filed away to slightly less than half its diameter, and then hardened and tempered to a deep straw colour. Failing one of these centre-bits, an ordinary countersink drill will answer the purpose, but be sure that the angle of the drill is the same as the angle of the lathe centres.

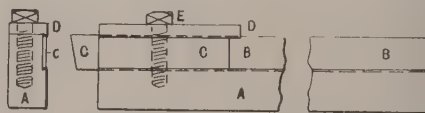


FIG. 10.

The work of centering is now complete. In actual practice it will have taken far less time to do than it has taken to write this description of how to do it, and though at first sight it may seem that a lot of unnecessary trouble is being taken, the reader will be amply repaid by the greatly increased accuracy and comfort with which he gets through his work, if he centres every job properly before he starts to turn it.

A Useful Parting Tool.

THE accompanying sketch illustrates a toolholder for using up broken portions of hack-saw blades as parting tools for the lathe. As will be easily seen, the body of the holder consists of a piece of steel or wrought iron (A), along one side of which is planed a recess (B, B) which is the same depth vertically as the width of the portion of blade used. The latter (C, C) has the teeth ground off, and the front ground to the angle shown for clearance. It is then ready to be fixed in the holder, projecting any convenient length from the end. The cutter (which the broken blade now becomes) is held securely down by a cover plate (D) about $\frac{1}{8}$ in.



thick, the underside of which is planed lengthwise, all but the very edge, which is left in order to grip the cutter more firmly. A screw (E) is used to hold the cover plate down to the body of the holder. It will be noticed that the raised portion of the holder adjoining B B is slightly undercut, so that between this edge and the edge of cover plate the cutter is gripped as in a clamp. Owing to the thinness of the saw blade, very little material is wasted in "cutting off" a piece of finished work, but it is necessary to remember that plenty of lubrication is needed, as the cutter is the same thickness at the bottom as at the top. This useful little tool was exhibited by Mr. Bryant at the last meeting of the Society of Model Engineers.

Model Yachting Supplement.

Doings of the Clubs.

[The Editor will be glad if club members will keep him posted up in the latest items of news suitable for this column.]

MR. S. B. COZENS of the Swansea Model Yacht Club writes: "I must ask you to correct an erroneous statement made by the secretary of the Tenby Model Yacht Club in your last issue, to the effect that one of the members of his club had made the sails of our most successful boats. This is entirely incorrect, none of our successful boats' sails having been made by any member of the Tenby Yacht Club." In this connection, we might, perhaps, point out that in the article referred to it is not stated that Mr. John Nicholls, the sail-maker in question, does belong to the Tenby club, so that our Swansea correspondent has apparently written without just cause. We shall be glad to know, however, who does make sails for the Swansea club, and to give our readers the benefit of the information. Will Mr. Cozens kindly oblige?

A meeting of the Newcastle, Jarrow, and Tynemouth Model Yacht Clubs representatives was held at Jarrow, on May 3rd, 1899, to make arrangements for the fourth annual race for the Tyneside Inter-club 15-Rating Championship Cup, in which the three clubs take part. The cup was won by Tynemouth in 1896, the first year of its institution, and by Newcastle in 1897 and 1898. Newcastle only require to win it this year for it to become their absolute possession. Needless to say, both the other clubs will do their best to avert such (to them) a disaster, so some excellent racing should be the result. It was decided to sail at Hexham Reservoir, on Whit Tuesday, and the sailing arrangements were left in the hands of Mr. H. Sharp, the secretary of the Tynemouth Club, who so successfully carried out last year's arrangements, and officiated similarly for the Alexandra Inter-club Cup Race sailed on Easter Monday last. The race is a full tournament, each club with six representatives, and every yacht sails all the yachts of the opposing clubs. The Newcastle and Jarrow teams which finished first and second last year will not be much altered, but the Tynemouth team will probably undergo a complete change, so that the racing should be very close.

Mr. Hugh Avery, Hon. Secretary of the Manchester M.Y.C., writes:—"Our present position is, that many old members have fallen off during the last two seasons, and but few new ones have, so far, taken their place. However, just at the commencement of this season we have several likely inquirers, and hope soon to be in a more prosperous condition. Our first races were sailed off on April 8th (the one fixed for March 25th had to be postponed on account of frost), when four boats entered for each race. There was a cold north wind blowing, and several showers of sleet and hail came on during the afternoon. In the 15-rater match, sailed on the tournament system, Mr. Gill's *Lapwing* was the winner of the first prize with 16 points, closely followed by Mr. Avery's

Titania, 15 points, and Mr. Bradbury's *Sapphire*, 14 points. The other boat, Mr. Goldthorpe's *Dolphin*, only scored 6 points, being over-canvassed for the strong wind. In the handicap (first heat), Mr. Dempsey's *Enequ* beat *Sapphire*; then, in the second heat, *Titania* and *Lapwing* tied with even points, the first-named winning in the deciding course. The final was an easy win for *Enequ*, which was sailing in good style; *Titania*, getting becalmed, came in a bad second. It is hoped that arrangements will be made between the Manchester and Liverpool clubs to hold inter-club races twice yearly for a challenge cup, towards which funds are being subscribed, and everything points to great interest being taken in these contests."

Mr. Wm. Cunningham, Hon. Secretary of the Leith M.Y.C. writes:—"This is only the fourth year of existence of the Leith M.Y.C., which is the first model yacht club ever formed in Leith, although model yachting has been indulged in in a desultory fashion for the past fifty years at least. The want of a pond has been a great hindrance to this fascinating pastime, and considering that there are 70,000 inhabitants in this seaport town, there is, I think, some room for grumbling. Generally we have to go to Dunsappie Loch on Arthur's Seat, Edinburgh, and there carry out our racing programme. Our membership the first year was twenty-five, next year forty, now we have between fifty and sixty members, who take a very active interest in designing, building, and racing of model yachts. At the end of each season—October—we have a social and dance—when the prizes won during the year are presented by one or other of our town councillors; last year it was Baillie Gibson, who presided over an audience of 250. This year we have accepted an offer, by the Horticultural and Sports Society of Leith, of a tent to exhibit our models. On these occasions the town is *en fête* and we mean to make a good show. Later on I hope to send you a photo of the office-bearers and Victoria Diamond Jubilee Cup."

Mr. J. A. Bruce, of the Kingston Model Y.C., Hull, writes:—"The inclement weather has prevented any activity, so far, this year, and business only yet has occupied the attention of members. The annual meeting was held in due course, showing a slight falling off in membership, but a healthy balance at the bank. All the old officers and committee were re-elected, and a provident programme decided on for the coming year. As soon as the floods which now submerge the banks of our pond have receded, repairs to the banks will be proceeded with, and then a match will be sailed with the East Hull M.Y.C., who have been the victors in the last two encounters between the clubs. The Yorkshire and Lincolnshire Challenge Shield will be competed for about June, and club matches will occupy most of the Saturday afternoons. Building operations have been quieter during the past winter than in any previous season, and no news of importance about fresh craft has come to hand. Several members who have in the past brought out something fresh every spring, have contented themselves with alterations, and will try their boats once again, instead of selling and coming forward with new ones."

The club now races only 10 in. models of the 1730 rule, and the same class prevails in the East Hull Club. We are behind the times very much in this matter, and it has been found very difficult to take any steps ahead."

* * *

The annual report of the South Shields M. Y. C.'s doings for 1898 is rather sad reading. The club competed in three inter-club matches—namely, the Thomas Norne Alexander Inter-club Challenge Cup, the Durham County Shield race, and an Inter-club race with the Tynemouth Club, but in all cases unsuccessfully. There was no want of energy on the part of the members, whose boats, however, are built rather on the lines of sea-going vessels than as racing models. The club was fortunate enough some time back to receive two fine yachts—one from Mr. Walter Runciman and one from Mr. J. H. K. McLean. The programme of "events" for the coming season promises some fine sport, and as much new energy will be put into the work, the club may reasonably expect to retrieve their fallen fortunes.

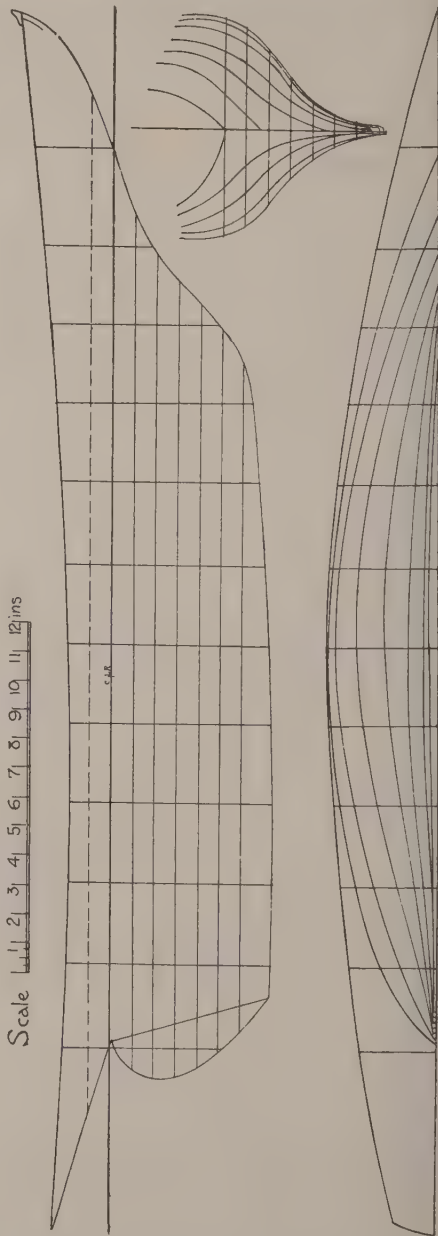
Design for a Model Cutter Yacht.

By GEOFFREY G. WACE.

IT is not much use building a model sailing yacht from the design of a modern racer, if you want her to sail straight, because a modern racer is cut away very much fore and aft, so as to turn quickly. Of course, she can be kept on a straight course by the helmsman; but a model, having no helmsman, must be kept straight by having a fairly long keel and upright sternpost. The principal dimensions of the boat to be described are: Length over all, 3 ft. 6 ins.; on water line, 2 ft. 7 ins.; beam, $7\frac{3}{4}$ ins.; draft, $5\frac{1}{2}$ ins.; overhang in the bow, $4\frac{3}{4}$ ins.; in the stern, $6\frac{1}{2}$ in.; freeboard (i.e., height of deck from water-line), $3\frac{1}{4}$ ins. at the bow, and at the stern 2 ins.

And now to build the model. Take seven planks, 3 ft. 6 ins. long (or a little longer, to allow for cutting), $\frac{3}{4}$ in. thick, and $7\frac{3}{4}$ ins. wide, and one the same length and width, but $2\frac{1}{2}$ ins. thick for the sheer strake or top plank.

The wood should be well-seasoned yellow pine, planed perfectly true. Mark the centre line on each plank, also the cross-sections *a*, *b*, *a*¹, *b*¹, &c.; then mark off the correct width at each section on each plank. Bend a batten, or thin piece of wood (lancewood preferably), to touch these spots, and draw a line through them. When all the planks are done, cut them out with a frame or compass saw, being careful to cut outside the lines. Screw these pieces together. The boat will then be of the correct size, but, of course, the edges of the planks must be cut off—that is, the lower edges, for if the shape of the upper edges is altered the shape of the boat will be altered. In cutting off these edges it is best to use fairly wide chisels and gouges, as they do not "nibble" so much as narrow ones and keep the shape fairer. It is well to make cardboard templates from the body plan, to fit the boat at the cross-sections. When the outside is true unscrew the planks, and mark round the lower edges a line about $\frac{1}{4}$ in. inside, but leaving more at the stem and stern; also one extra thick place should be left in the middle of each plank—say, at section *x*—so as to screw the planks together. The planks should now be cut out to the line and glued together with marine glue, put on hot (though ordinary glue will do), screwing the planks together with fine $1\frac{1}{4}$ -in. screws, placed one at the bow



DESIGN FOR MODEL CUTTER YACHT.

and at the stern, and one in each of the thick pieces at the sides in each plank. The boat should now be left twenty-four hours for the glue to harden. The inside should then be cut away as much as is possible with strength. A curved gouge will be found extremely useful for this purpose.

The outside must next be made as smooth as possible, and have one or two coats of red or white lead, each coat being rubbed down nearly to the wood with sandpaper or pumice stone. White lead mixed with whitening, about half and half by bulk, will be found very good for filling seams and cracks. It is better than putty, as it sticks better and sets hard sooner. The weight of lead for the keel is best found by floating the model and placing weights inside. This weight of lead must be melted, allowing a pound or so for waste, and run into a sand mould. If the weight is too much in the stern or in the bows, some of the lead must be cut away at that end and the space filled up with wood. The lead cut off may be hammered to shape and put inside the boat for trimming.



DESIGN FOR MODEL CUTTER YACHT.

For the deck, take a piece of $\frac{1}{4}$ in. or $\frac{3}{8}$ in. yellow pine, and plane down the upper edges to $\frac{1}{4}$ in. or slightly more, also slightly hollow the under side in the middle. Put the deck on the top of the boat (the sheer or curve from the bow to the stern having been cut off before screwing together for the last time), and draw round it. Now cut a rabbet a full $\frac{1}{4}$ in. deep round the top of the inside of the boat about $\frac{1}{2}$ in. from the outside; then cut the deck to fit the rabbet, and bore the hole in the deck for the mast. This should be $\frac{3}{8}$ in. in diameter. The wood used to make the mast, topmast, and spars, should be clear yellow pine.

The mainsail, staysail, and jib should be made of "embroidery" cambric, and the topsail and jib topsail of full muslin. Striped sailcloth, if preferred, may be had from Stevens, of Aligate, from Paxton, or from the Clyde Model Dockyard.

In all sails except the topsails the longest side of the sail should have a selvedge. In the case of the topsails the upper after-edge should have it. The bowsprit should be run through two brass "gammoning straps," as shown, which is, perhaps, neater than simply screwing the bowsprit down to the deck, and is certainly stronger. The mainsail should be run on brass rings on the mast if the sails are intended to lower, but should be laced with thread, as shown, if lightness is required; by lacing a sail may be got to sit much flatter than with rings. The

mainsheet should be fastened on to the boom through a ring on the "horse" (a wire fastened across the end of the counter, as shown) and then through another ring on the boom and twisted round a cleat on the boom. The cleat may be made of a small piece of hard wood and bound on with waxed thread. The staysail and jib should have light booms laced on them, and the sheets fastened on to the booms so as to make the sail sit flat. The mainsail should not be laced to its boom. The sheet of the staysail should work on a horse—the jib and jib-topsail on a bridle; the latter sail's bridle being worked on the spreader, which also stretches the topmast shroud out from the mast as the "dolphin-striker" does the bobstay. The best string for rigging is fine twisted fishing line.

With regard to steering the boat, there are several ways. Some leave the rudder solid on the model when cutting out to help in steering her straight. Perhaps the best way of all is with weighted rudders; these should be made of a slip of hard wood and sheet-lead, fastened on with thin sheet brass slips. Different sized rudders should be made, of course, so that the eyes on any of them will fit into the hooks on the boat. For sailing close-hauled a very small rudder should be used, but for before the wind a very large one, and the other sizes in proportion.

Guernsey Model Yacht Club.

THE adjourned meeting of the Guernsey Model Yacht Club took place on Monday, April 10th, at the Constables' Office at 8 p.m., Major Bernard presiding.

The Hon. Secretary read the notice convening the meeting, and then the minutes of the previous meeting were confirmed. At that meeting the following being elected:

Mr. C. A. Renouf, captain; J. W. Spiller, hon. treasurer; Ira C. Ozanne, hon. sec. and treasurer.

Committee: Captain Jones, harbour master, *ex officio*; Major Wright, Mr. B. Randell, G. Lihou, H. Turner, T. Ozanne, E. H. Zabiela, and F. Crespin.

Auditors: Messrs. H. H. Randell and G. Roberts.

Major T. Wellesley Bernard was then unanimously elected Commodore, the post of Vice- and Rear-Commodore not being filled up at present.

A proposition was made to alter the rule for measurement as follows:—Length on load water line plus girth load water line to load water line was put to the meeting; but after a long discussion it was proposed as an amendment that measurements remain the same as last year—viz., length overall and girth div. 2., with 10 per cent. allowance for overhang if it succeeds. This amendment was carried.

The Hon. Secretary proposed a new time allowance, similar to that in use by the Jersey Model Yacht Squadron, which was carried by a large majority. This will materially lessen the time allowed on small boats, the members finding the time allowed last year too great.

It was resolved to cancel the rule limiting the size of rudders.

Class racing was adopted, after a good deal of discussion, the idea being to have a champion in each class, and at the end of the season the holders of same to sail in a final for the championship of the club.

A hearty vote of thanks was accorded to the retiring officers and members of committee for their valuable assistance in the past.

A similar vote was also accorded to Major Bernard for the able manner in which he presided.

My Model Electric Cargo Boat, "Magnetic."

By S. L. THOMSTONE.

THE following brief description, photo, and drawings of a model cargo steamer may be of use to intending builders of an electric boat.

The hull is cut from a solid yellow pine block, 2 ft. 7 ins. by 4½ ft. 4½ ins., hollowed out to about 3 16ths in., except in the stern, where it is thicker, to allow of stern tube being bedded in watertight. There is a bulkhead amidships, which divides the boat in two, and also carries one end of the forward deck. The decks are of white holly, lined to imitate planking, and French polished. The raised deck amidships, with funnel and all fittings, lift off to allow of access to battery and motor. There are four hatches, each giving access to the hold. The

latter to the bridge. The raised deck is fitted with davits fitted into sockets, wheelhouse, two ventilators, and funnel; this acts as a ventilator to the battery, the whistle and valve pipe being dummies. The bridge is fitted with dummy compass, wheel, two telegraphs, and lifebuoys, and is supported on four pillars and wheel house. The four boats are cut out of yellow pine hollowed and covered with canvas, and hung on the davits by four pulley blocks each. The stanchions are turned from 1-16th in. brass wire with two holes drilled in each 1-64th in., to allow of wire being passed through to form rails. The standing rigging is silver-plated twisted wire. The motor is the usual form of electric motor, and will work at a good speed with two medium size Leclanché batteries. The bichromate battery, the one in the hold, is a porcelain jar with hardwood turned top, with terminals, carbons, and zinc fitted thereto; this will work the boat at full speed for about one hour. The propeller is a gun-metal three-



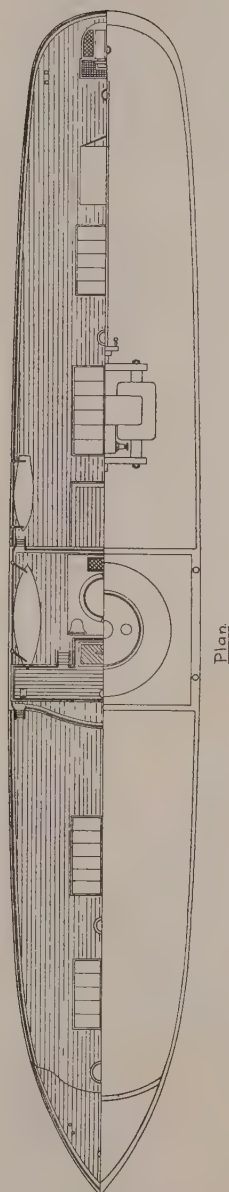
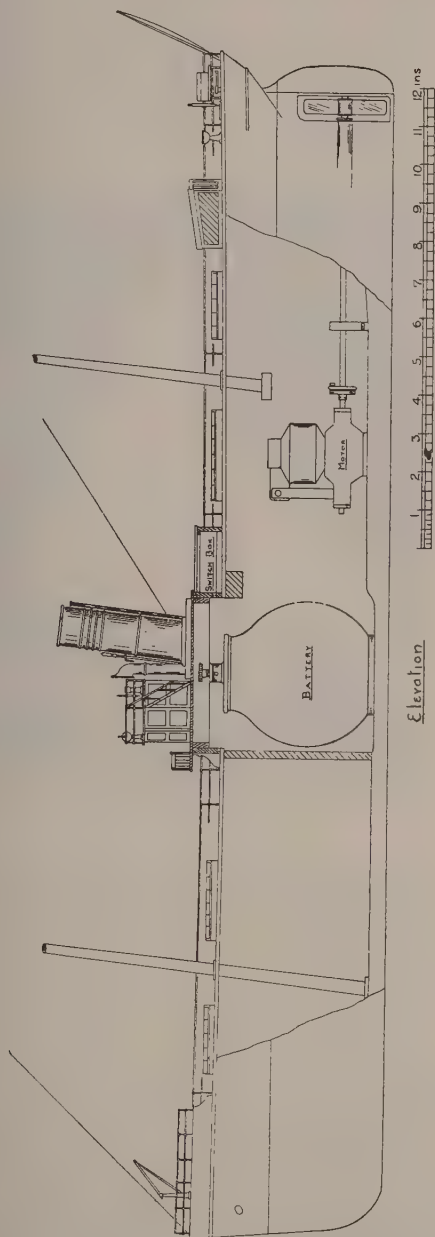
MODEL ELECTRIC CARGO BOAT, "MAGNETIC."

switch-box is aft the funnel, and the switch therein reverses the motor either to go-ahead, astern, or stop. There is also a companion-way on the after-deck. Immediately in front of the steering-wheel is a real working compass. The wheel is of brass, and was built up, the spokes being each fitted separately through the rim and boss. The quadrant on the rudder works by cotton on to the wheel drum, and so holds the rudder in any position by a turn of the wheel. The whole is covered in by a box, supported on four brass turned legs. The rudder is also fitted with the usual chain, so as to steer in case of accident to the ordinary steering gear. There are mooring bitts forward and aft, and guides to same turned from brass wire. The anchor chain is also made out of thin brass wire, which runs through hawse pipes on to the deck alongside the capstan. There is a small crane at the stern for lifting the anchors on deck.

The masts are telescopic, which allow of top masts lowering down the middle. The derrick booms are hinged to the masts with the usual fastenings, which allow the derricks to swing in any position, and rest in holders when not in use. There are four sets of brass steps from the lower decks to the raised deck, and two sets from the

bladed one, secured to the shaft by a very small setscrew. The weight of the boat ready for sailing is 10½ lb. The design of the boat with all fittings and working parts, I have made and fitted up myself, and has taken 400 hours to complete. This is strictly an amateur production.

Steering gear for model yachts is evidently a specialty of the Clyde Model Dockyard, 24, Argyll Arcade, Glasgow, for, in addition to selling a quadrant steering gear, they have just introduced a new patent sliding gear, which, we are informed, has been adopted by most of the Scottish clubs. The gear is made in different sizes, suitable for boats of the 2½-rater up to the 20-rater class. We have also received a sample of a strong and well-made spider hoop and goose neck, which is made in any size to order; a neat bowsprit cap, and a strong boom-bridge or horse—all of which are very moderate in price. Apart from their large stock, the Clyde Model Dockyard make all kinds of yachting requisites to order. In the complete illustrated catalogue issued by this firm (post free, 4d.), will be found particulars of model yachts and fittings of every description.



MODEL ELECTRIC CARGO BOAT, "MAGNETIC."
 Drawings showing Sectional Elevation, and Plan.
 (For description see opposite page.)

Our Model Yachting Prize Competition.

WE are pleased to be able to report that this competition has met with a good deal of favour amongst our yachting readers, and that a number of entries were received, many of them being very good. We must confess to experiencing some difficulty in making our award, for several of the competitors ran each other very close in point of merit. Some sent good photographs, but poor descriptions; while others erred in the opposite direction. Taking all points into consideration, however, we have decided to award the prizes to Mr. S. B. Cozens, of the Swansea Model Yacht Club, 9, Brunswick Street, Swansea, for the photograph and description of his boat, *Lady of the Lake*; and to Mr. W. T. Vine, of the Highgate Model Yacht Club, 15, South Hill Park Gardens, N.W., for the photograph and description of his boat, *Mildred*.

A cheque for 10s. 6d. has accordingly been posted to each of these gentlemen. We reproduce Mr. Cozens' photograph and description herewith, and will publish Mr. Vine's competition in our next issue.

The following competitors are worthy of honourable mention in connection with this competition:—Wm. Noble (Tenby); J. Marshall (Leith); H. P. Lee (Brixham); H. H. Tansley (Lowestoft); R. P. Tansley (Lowestoft); and Alex. Flockhart (Edinburgh).

We give elsewhere in this number particulars of a new competition, which we hope will attract an equally good number of entries.

THE "LADY OF THE LAKE."

(Owner, Mr. S. B. Cozens.)

The accompanying photograph shows the champion model yacht for the last three years of the Swansea Model Yacht Club. Her name is *Lady of the Lake*.

Dimensions :	Ft.	ins.
Length over all	5	7½
Length L.W.L.	3	8
Beam	1	1
Draught	1	0
Lead keel, 13 lb.		

Sail area :

Mainsail	1413'1 sq. ins.
Topsail	330 "
Jib	649'9 "

Total S.A. 2393'0 "

Her hull was built in 1895 from a double centre-plate design of a small rater which appeared in the *Yachtsman*.

I bought her in June, 1896, and on the following August Bank Holiday she won her maiden race in Swansea, carrying off a very handsome silver cup, and would undoubtedly have taken the prize in the second race on that day had she not been debarred from starting on account of having won the cup.

However, notwithstanding this, she finished the season with more wins to her credit than any of the boats which had been sailing the whole year.

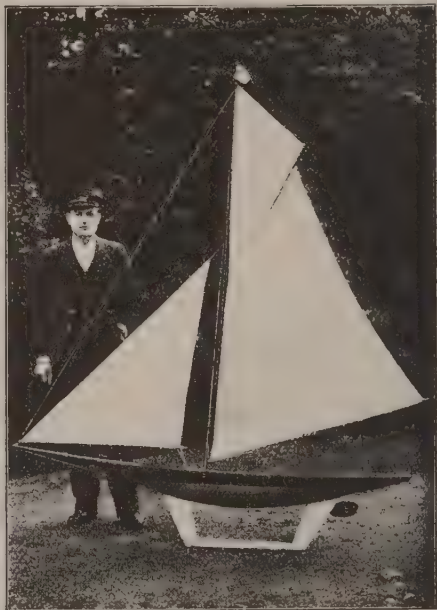
Her last race in 1896 was sailed in a gale of wind, when she came home an easy winner, only one other boat being able to get out of the lee corner, so big were the seas.

In 1897 she increased her reputation, and came out top with three first prizes, two seconds, and one third; the next boat having one first, four seconds, and one third prize.

This was the first year in which she competed for the challenge cup between the Swansea and Cardiff M.Y.C.'s, and which she would most likely have won

had she not fouled another boat when leading, and although this put her last, she succeeded in taking second prize. The club this year commenced a series of tournament races for a championship flag of the year, which she also secured, and it may be seen flying at the topmast head.

In 1898 she eclipsed all previous successes, winning four special prizes in succession, the fourth one being the annual challenge cup on Easter Monday. In this race she was the only Swansea boat in the final heat, and so had to sail against five Cardiff boats. However, she



THE "LADY OF THE LAKE."

easily distanced them all, and romped home in fine style, finishing seven minutes ahead of the second boat.

Notwithstanding a misfortune she encountered in getting entangled in a bed of water-lilies, while two races were being sailed, she still retained her position as champion of the year. In the scientific and industrial exhibition held here in 1898, she was the only model awarded a diploma and gold medal for a racing model yacht.

Want of space forbids my mentioning numerous smaller prizes she has won. She is fast, an excellent boat to windward, and a good runner; also steady, and very reliable, and with a strong breeze and a big sea running a very hard boat to beat.

Mr. H. M. Parks, of Terminus House, Cornfield Road, Eastbourne, has sent us a price list of model-yacht parts and fittings of which he makes a speciality. These include all kinds of blocks, dead-eyes, cleats, hooks, flags, rigging cord, &c., as well as such ornamental fittings as binnacles, steering wheels, ventilators, miniature boats, life-buoys, hatchways, anchors, guns, &c. Judging by some samples sent for our inspection, these goods are well finished and moderate in price. The list may be had post free for 1½d. on application.

Correspondence.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a non-deplume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication. Communications should be written on one side of the paper only.]

Inter-Club Measurement Rule.

TO THE EDITOR OF *The Model Engineer*.

SIR,—The model yacht clubs of the south-west of England have fallen into line on the measurement rule, and adopted the old $\frac{LWL \times SA}{6000}$ in inches.

The other rules in force among model yacht clubs are LWL and $\frac{(L \times B)^2 \times B}{1730}$. The result of the first, or

simple length, rule in yacht racing was the production of yachts with great beam, deep and heavily weighted keels, and enormous sailspread. They were stumpy, wet, uneasy, and bad sea-boats, and to prove that this rule fostered a bad type, when the rule was altered, some of the Southampton "length-class" yachts were lengthened at both ends, to their great advantage—witness *Yum-Yum*, *Curly*, and *Volador*.

The 1730 rule evolved the "plank on edge," and the tendency is the same in models (see the hon. sec. of the Tynemouth M.Y.C. in your last issue). "The type of boat we think best all round is the long, narrow boat." Why, certainly—nothing else has a chance under that rule.

The above rules cramp design and stereotype form. With the $L \times SA$ the designer is free, within the following practical limits, to adopt any type he has a fancy for:

FIVE-RATING.		TEN.		TWENTY.	
LWL	SA	LWL	SA	LWL	SA
24	= 1250	30	= 2000	40	= 3000
36	= 833	42	= 1428	54	= 2222

Allow me to congratulate you and your subscribers on your new supplement. I enclose cost and postage for six extra copies to send to neighbouring model yacht clubs.

—Yours truly,
G. J. WATSON,
Com., Plymouth M.Y.C.,
Hon. Sec., Port of Plymouth Regatta.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I desire to join with Mr. Fordsmith in his delight at your giving us a Model Yacht Supplement, whereby mutual benefit will, I am sure, accrue to those interested in this (miniature) national sport. The question of an inter club or general measurement rule is one that is in sore need of attention, as a number of the present almost innumerable rules are complicated, and in various cases inadequate. A rule should be simple, readily understood, and easily applied, but at the same time *tax the power* of the model.

I do not think that it will be possible to adopt the one-design class, even in the local sense, because a large number design, build, and sail their own—which gives an immense amount of pleasure—and further, it is not all that can afford to buy. Taking the L.W.L. (only) rule, this appears to me to be the most inadequate rule I have seen. It is open to great abuse, producing in many cases anything but yacht-like craft.

From my own observation, length is the last thing to be taxed. Why omit *beam* and *draft*, which give the sail carrying powers of a yacht? These two should be taxed, one as much as the other, so that if this is done a rule bothering with sail area is not wanted. The latter

confuses many designers who are not conversant with calculations, yet who desire to design and have a yacht handicapped in a certain class or position, and at the same time obtain the fastest speed; but to find, after all the trouble, that the sail area must be reduced below what should be carried to get there is not good for the sport, as every yacht should be allowed to do her very best work.

Could you tell me how girth is taken in the Guernsey Club rule, also why overhangs are taxed by it?

My favourite rule, up to the present, and I have not seen one yet to beat it, is, viz.: Tonnage = L. plus (B. plus D. multiplied by 2) divided by 4, length and greatest breadth being taken on L.W.L. This rule readily taxes all questions of power and sail and it cannot be got away from; it does not create any exaggeration in length, as might be suggested, otherwise that must be paid for. What is the good of length, without beam or draft to drive it? I have known this rule working for years and I have never seen a model for which it did not work out fairly, whether old or new type, so that it could in all fairness be adopted for existing models, which must be considered in this question.

Perhaps after full discussion a vote may be able to be taken on this subject. Therefore, as a start, I would advocate *properly tax "hull"* only, for what it is, neither more nor less, and leave sail area alone, as this is in the hull, thus giving an owner the opportunity to get the most he can out of his yacht, which is the only true test.

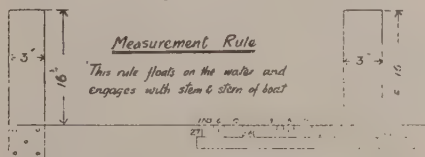
Kindly pardon my being so lengthy, but love of the sport is my plea.—Yours faithfully,
Cardiff, May, 1899. O. B.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The following is the way the boats in our club are measured, and I consider it to be a very just method to adopt. We have four classes, and the measurements are determined by adding together the beam and the length on the L.W.L. Thus, a boat with a length on L.W.L. of 30 ins., and a beam of 10 ins. (30 + 10 = 40), comes in Class I., which includes 40-in. boats and under. The four classes are:—

- Class I.—40 ins. and under.
- Class II.—40½ " to 50 ins.
- Class III.—50½ " to 60 "
- Class IV.—60½ " to 70 "

It will be noted that there is a margin of ¼ in. separating the classes. The above measurement is obviously based on the floating surface, and the club does not



restrict sail area at all. The owner of a boat will not be long in finding out the amount his boat requires, and he will soon get to know that too much sail is worse than too little. The accompanying sketch shows the adjustable rule which we use for measuring the boats with. It floats flat on the surface of the water when in use, and the sliding arm can be readily adjusted to the required length. I shall be pleased to give any further information if desired.—Yours truly,

ALEX. FLOCKHART, Secretary,
Edinburgh and Leith M.Y.C.

Edinburgh.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—We have had considerable experience here of model yachting, having been in existence now for fourteen years. The Dundee Model Yacht Club was established 1885. After various trials of different rules, we finally adopted the following tonnage measurement by weight, allowing $1\frac{3}{4}$ lb. to ton:

5-tonner not exceeding	$8\frac{3}{4}$ lb.
10 " " " "	$17\frac{1}{2}$ "
15 " " " "	$26\frac{1}{4}$ "

This without spars, sails, or rudders.

I can speak very favourably of this plan of model-yacht measurement as being the simplest; and yet allowing the greatest scope for design of model—within the last three years the favourite type of boat has been shallow body, great beam, with thin wood keel and lead bulb. Our 10-tonners are 48 ins. over all by 12 ins. beam; 3 ins. deep in body of boat, with a 6 to 9 ins. keel $\frac{1}{4}$ in. thick; some keels of thin steel. My own 10-tonner weighs $16\frac{1}{2}$ lb., and sails very fast, and will also stand a very heavy blow. In looking back to my old experiences of the deep-keel boat, I sometimes wonder why I could have been bothered with such a type of craft so small for a 10, and so heavy as it was.—Yours truly,

Dundee M.Y.C.

G. W. RITCHIE.

Wirral Model Yacht Club.

THIS club was instituted in June 1898, and now contains about one hundred active and honorary members.

Officers.

Commodore—Roy McGregor Laird, Esq.

President—James T. Thompson, Esq., T.C.

Vice Commodore—W. L. Morris, Esq., T.C.

Rear-Commodore—Captain P. McQueen.

Vice-President—G. H. Willmer, Esq.

Captain—John A. Dickenson, Esq.

Vice-Captain—J. Rule, Esq.

Sailing and Steam Committee—Messrs. E. W. Wynne, Jas. Sherlock, John Tharm, James Clark, Henry Bawden, Chas. Kind, John Frazer, J. R. Simm, R. Walmsley, J. Kirkpatrick, W. Ashton, J. A. Dickenson, William Dickenson.

Hon. Treasurer—James Simm, Esq.

Hon. Secretary—J. M. H. Taylor.

Hon. Patrons—Sir Elliot Lees, Bart, M.P., Dr. T. W. A. Napier, John Kinghorn, Esq., M.I.N.A., Captain F. J. Croft, Esq., Alfred Nickels, Esq., and G. J. Coombs, Esq.

This is the first real working season of the club and the undermentioned number of races to be got through clearly shows that this club is determined to be one of the foremost model yacht clubs in the United Kingdom.

The races, both steam and sailing, are held at the Lake, Central Park, Liscard, Cheshire, and a good many entries are obtained for each event, so that, as a rule, a most enjoyable Saturday afternoon is spent there by the members and the public generally.

The racing commences at an hour which is found most suitable to the member, viz., 4 o'clock, and generally lasts one or two hours.

The special feature of the steamer races is that they are run on time allowance, each steamer having to run the full length of the lake twice up and twice down, and as only one steamer is going over the course at a time there is no fear of her chance of winning the race being spoiled by collision with another steamer.

The steamers are handicapped accordingly, viz., water-line length added to twice the breadth, added to draft,

added to weight, added to pressure of boiler. The difference of the smaller deducted from the larger and divided by four, shall be the time allowance in seconds for 500 yards, the length of our lake.

On July 29th a rather novel race is to be held, viz., an endurance race of 40 minutes duration, the steamer doing the greatest number of lengths of the lake in that time to be the winner and to receive a gold medal, the next two best to receive silver medals.

It is proposed to hold an exhibition of the club models in Birkenhead, in June, and as there are some very beautiful and thoroughly up-to-date models (both steam and sailing) in the club, the exhibition, from a model-yachtsman point of view, promises to be very interesting, as well as useful, to those in search of novelty in this line.

Race Fixtures for Season 1899.

April 22, for sailing boats, 4 ft. w.l.—First round for the President's cup and 1st, 2nd and 3rd certificates.

May 6, steamers under 7 ft. w.l.—First round Commodore's cup and 1st, 2nd and 3rd certificates.

May 20, for sailing boats, 3 ft. w.l.—First round Commodore's cup and 1st, 2nd, and 3rd certificates.

June 3, for steamers, handicap under 7 ft. w.l.—1st, 2nd and 3rd prizes.

June 17, for sailing boats, 2 ft. w.l.—1st, 2nd and 3rd prizes; medals.

July 1, for steamers under 7 ft. w.l.—Second round Commodore's cup and 1st, 2nd and 3rd prizes; gold and silver medals.

July 15, for sailing boats, 4 ft. w.l.—Second round President's cup and 1st, 2nd and 3rd prizes; gold and silver medals.

July 29, for steamers, endurance race, 40 minutes.—1st, 2nd and 3rd prizes; gold and silver medals.

Aug. 12, for sailing boats, 3 ft. w.l.—Second round Commodore's cup and 1st, 2nd and 3rd prizes; gold and silver medals.

Aug. 26, for steamers under 7 ft. w.l., handicap.—1st, 2nd and 3rd prizes; gold, gold centre silver, and silver medals.

Sept. 9, for sailing boats, 2 ft. w.l., *Special Race*.—1st, 2nd and 3rd prizes; certificates.

Sept. 23, for steamers, handicap.—Third round Commodore's cup and 1st, 2nd and 3rd prizes; certificates.

Oct. 7, for sailing boats, 4 ft. w.l.—Third round President's cup and 1st, 2nd and 3rd prizes; silver medals.

Oct. 21, for steamers, handicap.—1st, 2nd and 3rd prizes; medals.

Nov. 11, for sailing boats, 3 ft. w.l.—Third round Commodore's cup and 1st, 2nd and 3rd prizes; medals.

On August Bank Holiday a match will be run by sailing boats for the Vice-President's prize for 1-raters, Y.R.A. rules, one inch to the foot scale.

The Captain, Mr. John A. Dickenson, intends giving a prize for sailing models' best average during the season.

Mr. E. W. Wynne is giving a similar prize for the best average among the steamers.

Two consolation prizes will be given, by Messrs. W. Dickenson and H. Bawden, for sailing boats that have never won a race.

The club flag is a white burgee, with the Wirral arms thereon, and the initials W.M.Y.C. in blue letters.

The Tynemouth Model Yacht Club send us their neat little printed programme of 1899 fixtures. From this it will be seen that nothing is wanting in the matter of prizes to make model yacht racing a great success at this north-country post. The season commenced on March 25th with a race for 10-tonners, and will continue throughout the summer until November 4th, every variety of rating being well represented.

Racing Reports.

[Secretaries are invited to furnish the Editor with regular reports of their club races, for free insertion under this heading. The value of these reports to other readers will be greatly increased if some detailed particulars as to design and measurements of the winning boats are given.]

Surbiton M.Y.C.—On Saturday, April 22nd, a 20-rater sweepstake of this club was sailed, when the *Penitent*, *Kit*, *Moss Rose* and *Britannia* competed, the *Kit* winning with 15 points to her credit, the next best totalling 10 points. On Saturday, April 29th, a 10-rater challenge cup race took place, the entries being:—The *Rose*, *Daphne*, *Ruby* and *Kittiwake*, and after a most exciting race, the *Ruby* and *Daphne* tied with 24 points. It having been decided to sail off the tie, the *Ruby* won by 2 points. On Saturday, May 6th, a 20-rater challenge cup competition, for possession of the cup for the year was sailed, the *Fanny*, *Penitent*, *Britannia* and *Kit* competing, the *Kit*, after a desperate struggle, managing to win. The wind was from the N.E. and very fluky. Mr. Lane, the owner of the winning model, must be congratulated on his success, he having designed and built the model, which is a very smart and fast vessel.

Serpentine M.Y.C. (London).—This club has been rather busy the last month or so. On April 8th, a race was sailed on the Serpentine by the 20-raters:—*Meteor*, *Diamond*, *Carina*, *Lone Star*, *Dora*, *Mascotte*, resulting in the *Diamond* securing first honours. On May 6th there was a race for 10-raters. The entries included *Kite*, *Kestrel*, *Mohawk*, *Jubilee*, *Novice*, *Swift*, *Snake*, *Carego*, and *Petrel*. After a hard-fought race, the *Swift* won with 21 points, *Snake* coming next with 10. There has also been some individual sailing to decide the question of best sailing in the 10-rating class. The result at present is that *Snake* and *Swift* are left to meet two more antagonists and then fight out the issue.

Tynemouth M.Y.C.—A race for 15-ton yachts was sailed on April 22nd. The wind, which before the start was very light and changeable, settled to a good breeze from the south, the course being a dead beat to windward, and nine yachts started in the tournament. Some capital racing was witnessed, many of the heats being won "on the post," the first four yachts especially being evenly matched. These were *J. Stewart's Jim*, *T. Foster's Iverna*, *W. Sharp's Rover*, and *C. Addison's Irene*, which eventually finished in the order named. The *Jim* might be considered fortunate to win, as she lost to the *Iverna* and just beat *Rover* and *Irene* on the line in the original tournament, and tying with *Iverna*, which had been beaten by *Rover*, in a good decider, *Jim* this time just beat *Iverna* after a splendid race. The *Rover* and *Irene* tying for third prize, sailed an excellent final, *Rover*, which had lost to *Irene* in the tournament, winning a good race. The scores of the yachts were:

Vins. Losses.

J. Stewart's <i>Jim</i>	7	...	1 (1st.)
T. Foster's <i>Iverna</i>	7	...	1 (2nd.)
W. Sharp's <i>Rover</i>	6	...	2 (3rd.)
C. Addison's <i>Irene</i>	6	...	2
B. Foster's <i>Ariel</i>	4	...	4
K. Walton's <i>Corsair</i>	3	...	5
J. C. Reny's <i>Nellie</i>	2	...	6
H. Sharp's <i>Aurora</i>	1	...	7
F. Hudson's <i>Baleen</i>	0	...	8

This makes the fourth race this season which Mr. Stewart has won—an excellent performance, though in the last two not until after winning a deciding heat with the second yachts. The 15-rating race fixed for May 6th

had to be postponed through the E. wind curling round the end of the Tynemouth Aquarium, which covers more than half the east side of the Tynemouth Park lake. The race is to be decided on May 20th. As eleven 15 raters turned up, a tournament was commenced but had to be given up before it was concluded, owing to the wind getting worse.

New Prize Competitions for Model Yachtsmen.

WE offer a prize of 10s. 6d. for the best article on the subject of "Model Yacht Measurement." The article should describe in detail the principal methods adopted for measuring and classing model yachts, and should explain clearly the relative advantages and disadvantages of the particular methods described. Competitions should bear the full name and address of the sender. The closing date is June 10th. All competitions should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C. The winning article will be published in due course, but the Editor also reserves the right of printing the whole or part of any of the unsuccessful articles which he may think worthy of reproduction in the paper.

Special Note.—We contemplate offering a prize for the best design for a model sailing yacht. We shall be glad to hear from readers as to the class of design they think would be most popular, so that we may frame the conditions of the competition accordingly.

From the Port of Brixham M.Y.C. we learn that a full programme of fixtures has been planned, beginning with five test matches for 20-raters. These matches are to decide on three best models to be sent to Plymouth for competition for the "West of England Challenge Cup." The home matches for the season are for boats in two classes—namely, for 15-raters to 20-raters (which will sail together without time allowances, boats over 20-rating allowing half-minute per rating), and 5-raters to 10-raters (which will also sail without allowance, half a minute allowance per rating being given by all boats over 10-rating and up to 15-rating). The first of these is to be sailed on Saturday, April 15th, the other races following on alternate Saturdays during the season.

* * *

One of the latest methods of communicating between the passengers and guards of a train in motion is that devised and patented by Messrs. D. F. Laing & Co. In this system the air pressure used in working the Westinghouse brake is employed to blow a whistle in the guard's van and on the engine by turning a handle in any compartment of any carriage in the train. At the same time an indicator arm is thrown out at each side of the carriage, which intimates to the guard or driver in which carriage the handle was turned. The invention, by a slight alteration, is applicable to trains worked with the vacuum brake. The handle is fixed on the wall of the compartment just under the hat-rack, and the inventors suggest that it be enclosed in a circular casing with glass front, to prevent accidental tampering with it. This, however, is not absolutely necessary. The increasing number of cases where some means of communication between passenger and guard will soon make such communication an absolute necessity, and the system described above has points of strong merit, including simplicity and certainty of action.

The Editor's Page.

THE competition for the best description of a model electric motor-car apparently set too deep a problem for most of our readers, for the entries have been very limited in number. However, in each of the articles sent, it is evident that the competitor has thought the subject over very carefully and has taken considerable trouble to produce a satisfactory design. We have judged the effort of Mr. G. H. Rooke, School House, Handsworth, Sheffield, to be the best received, and we have therefore awarded him the prize of £2 2s. At the same time, we desire to select Mr. K. H. Evans (Ashburton) and Mr. F. Thomas (South Hackney) as worthy of commendation for the work they have sent in.

There is another competition still open, in which a somewhat wider scope is afforded, and as there are two prizes to be given we trust a correspondingly increased number of entries will result. The closing date for sending in is June 30th, and the other particulars are given further down on this page.

We are glad to be able to report that the introduction of our Model Yachting Supplement has given very general satisfaction, not only amongst members of model yacht clubs, but amongst our older readers who have a nautical turn of mind in addition to their engineering predilections. In proof of this, we have received a considerable number of letters expressing appreciation of the departure, and, so far, only one raising any objection at all. In the latter case, the writer argued that increased electrical matter in place of the yachting matter would be more to his taste. We cannot, of course, expect to please everybody—no paper has yet been published which achieved this feat—but we certainly have no intention of neglecting the electrical section of our readers, and can promise them plenty of interesting matter in due season. Apart from this, we are inclined to think that electricity had a fair share of our last issue, about which the before-mentioned correspondent complained.

The little book on "The Slide Valve," by our valued contributor, Mr. W. J. Tennant, is now on sale, price 6d., post free 7d. It may be obtained from any of the usual agents for THE MODEL ENGINEER, or, failing this, it may be ordered through any newsagent or bookseller, or obtained direct from our Book Department, 6, Farringdon Avenue, London, E.C. We can commend the book for its really excellent explanation of the working of the steam engine slide valve, put in such a way as will enable any young engineer to easily understand this important subject.

From a subscriber in Italy comes the following: "Perhaps the following notes may interest some of your readers. One of the most recent installations of electric tramways, probably, is the one put in use in Florence in the fall of 1898. The old plan consisted of one line about six miles long, ending in a very steep ascent of

two miles. It was fed by two vertical 90 h.-p. engines, driving each a Thomson-Houston dynamo of equal power. The new plan consists of ten separate trolley lines, varying from three to ten miles, of which six are already in full work. The motor-cars are 102, of which forty-five are in daily use. They are of the Thomson-Houston type, 30 ft. long, and furnished each with two 25 h.-p. motors, and can draw two passenger trail cars at full speed. Of these trailers, at present, about thirty are in use. The power is furnished by a central station comprising four multitubular boilers working at nine atmospheres pressure. The engines are three: two 950 h.-p. and one 450 h.-p., all tandem 2-cylinder condensing compound engines, running at 120 revolutions. They are built by Escher, Wyss & Co., of Zurich. They are coupled directly to three multipolar dynamos built by the General Electric Company, of Schenectady, N.Y., U.S.A. The two large dynamos are 8-polar and furnish 775 ampères at 550 volts. The small one is 6-polar and gives 409 ampères also at 550 volts. Only one of the 950 h.-p. engines works daily now. Later on, at the completion of all the lines, the 450 h.-p. one will work daily also."

A firm of model-makers in Natal writes as follows:—"Where can we get plans of American palace or sleeping cars, as we are making a model of an American locomotive, 1 in. scale, about 5 ft. long, with tender. Our only trouble is having to import from home or America every little thing that is wanted, as nothing can be got in this country." Can any reader give us the desired information, so that we may forward same to our correspondents?

It has been suggested to us that it would be a good thing if an afternoon meeting could be arranged at one of the London ponds for readers who have model steam or electric boats which could be shown at work, or for which races could perhaps be arranged. We shall be glad to hear from readers who would be willing to bring their boats to such a meeting, and also to have any suggestions with regard to making the affair a success, if proceeded with.

New Prize Competitions.

COMPETITION No. 7.

TWO PRIZES of £1 1s. each are offered for the best descriptions of how to make a working model suitable for driving from a small engine or gas engine, or electric motor. The model described may be a miniature machine tool, crane, pump, or agricultural machine, printing press, or any mechanical model with which the competitor is familiar. Full working drawings should accompany the description.

The closing date for this competition is June 30th. (See *General Rules*.)

GENERAL RULES.

For general rules governing this competition see previous issues of THE MODEL ENGINEER.

All competitions should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.

Practical Letters from Our Readers.

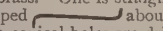
[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.]

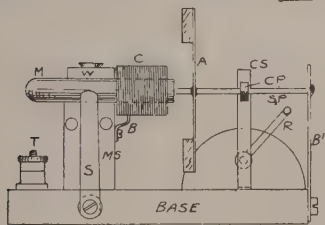
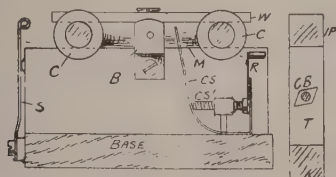
Simple Electric Motor.

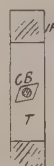
TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Perhaps the following description of a simple electric motor may interest some of your readers. It can be constructed very cheaply, and, if properly made, will run at a great speed.

The magnet support (MS) and base are made from a piece of wood of a suitable thickness, and varnished. The magnet (M) is made from a piece of soft iron rod, $\frac{1}{4}$ in. in diameter and about $\frac{1}{2}$ ins. long. It is wound with No. 26 s.c. wire, about $\frac{1}{2}$ oz., but 1 oz., I think, would be better. The magnet is held down on the support by a piece of wood (W) laid across the magnet, and a screw passing through the wood (W) into the support.

The next thing to make is the two bearings (B and B¹) of stout brass. One is straight, about $2\frac{1}{2}$ ins. long; the other shaped  about 1 in. long. In the end of each, two conical holes are drilled for the spindle (SP) to run in. At the end two holes are drilled right through for the screws which fasten them to the base and magnet support.



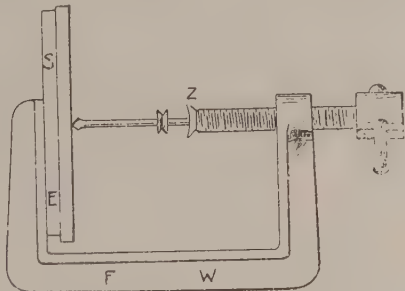
The spindle is made from a very fine knitting-needle, the ends filed to run in the conical holes in the bearings (B and B¹). The armature is made of two square pieces of iron (IP), $\frac{3}{8}$ in. square, soldered to a piece of tin (T) about $1\frac{1}{2}$ ins. long. The armature must then be soldered on the spindle, so it runs quite true, as near the magnet as possible without touching. The contact breaker is a piece of copper (CB), shaped  about $3\frac{1}{16}$ ins. long, soldered on in a position as shown, but the best position is found by experiment. The spring (CS) is a piece of watch-spring, which is made to approach or recede by the screw (CS¹) worked by the handle (R) which regulates the speed. A switch is fitted as shown at S. Two terminals are fitted at the back. The current goes from T to magnet, from magnet to bearing, through contact breaker and spring to switch, and from there to terminal (T¹) not shown.

The motor runs about 2000 revolutions per minute, with a quart bichromate. It is well worth making. I have shown it to several friends who think it very good, and one has made one the same with the same success.—Yours truly,
J. W. T.
Richmond.

A Small Drilling Frame.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I enclose sketch of a small drilling frame, which can be made out of an ordinary table clamp. A faceplate (SE) is brazed, soldered, or bolted on as shown, and has a sheet of rubber or soft wood fixed on its face, so as not to spoil the drill by too much pressure of the



screw. The end of the screw (Z) has a small hole drilled in it for a short distance, for the end of the drill to revolve in.

The part FW is fixed in the vice, and the work is fixed up against SE. The ferrule of the drill is rotated by means of a bow. Small drills should only be used.—Yours truly,
"WINDER."

Luton.

Tempering Small Tools.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—I am pleased to be able to give the following quick recipe for hardening small tools:—Take the drill, or other tool, anything up to $\frac{1}{8}$ in.; make it a cherry-red in a clear fire or gas-jet at cutting points, and plunge it at once into a raw potato, leaving it there until cooled. I may say that I have never found this to fail, and have hardened even small lances in this manner, and the result has been a beautifully keen edge, with a very desirable toughness. A little experience is needed in getting the right redness of heat for different uses of tools.

Small taps up to 5-32nds in. I have been most successful with, making them a good red heat, and plunging them into the flat end of a composite candle, and leaving them in it to cool, care being taken to keep the candle vertical during the operation.—Yours truly,
E. C. J.

Cardiff.

Small Tools for Model Work.

TO THE EDITOR OF *The Model Engineer*.

SIR,—In reply to Mr. Shaw's letter, I beg to state that I do not see the advantage of cutting a duplicate thread on the barrel. In the first place, such a thread would be difficult for an amateur to cut, besides being unsightly, and liable to damage. In the second place, the barrel of a small lathe is almost always too small in diameter to admit of sufficient shoulder being left for a faceplate to screw up against. For instance, in the excellent lathe described in your pages by Mr. Waller Martin, the mandrel nose is 1 in. diameter, and the

barrel $1\frac{1}{2}$ ins. I can assure your readers there is no probability of the faceplate turning round, if fitted with a tapered plug. Many drill chucks are fixed to the mandrel in this manner, and give satisfaction.—Yours truly,
Middlesbrough. S. C.

Forgings for Model Engines.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Will you kindly allow me to offer a little advice to fellow model makers who may have occasion to order forgings for small engines, say, $\frac{1}{8}$ h.-p. and upwards? My remarks are intended to guide anyone dealing with the local smith, who, unless, he understands engineer's

tages of iron, but insist on having mild steel. I send a few examples which may be of use. The solid lines show forging shapes, and the dotted lines finished shapes. Omit the latter in sending to the smith. Fig. 1, crank properly forged; Fig. 2, ditto imperfectly forged; Fig. 3, correctly shaped eccentric strap; Fig. 4, marine type connecting rod; Fig. 5, joint for rod ends, &c. Note in Figs. 1, 4, 5, that they are forged solid at A. This should always be done in small work. The above hints are applicable to forgings for engines up to about 6 h.-p.—Yours truly,
Clapham. E. W.

Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, FARRINGTON AVENUE, LONDON, E.C.]

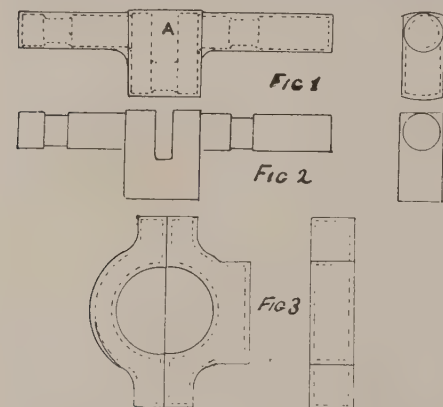
The following are selected from the queries which have been replied to recently:—

[976] **Model of G.N.R., No. 990.** H. S. G. (Acton) writes: I am about to construct a locomotive, and, after considering the various types, have decided on making a model of Great Northern (No. 990). I have a pair of $\frac{3}{4}$ in. by $1\frac{1}{2}$ in. slide-valve cylinders, and propose using these, which will be quite large enough, as I only want to make a small model. Can you give me the sizes for the under-mentioned parts? Diameter of driving wheels, diameter of bogey wheels, diameter of trailing wheels, gauge of wheels, length of side frames, width of bedplate, size of boiler, diameter of barrel, length of firebox, width of firebox, number of tubes, diameter of tubes, thickness of boiler plates, pressure boiler should be worked at if rivetted and made steam-tight by sweating solder. Do you have any paper or book where instructions have appeared for making this class of engine?

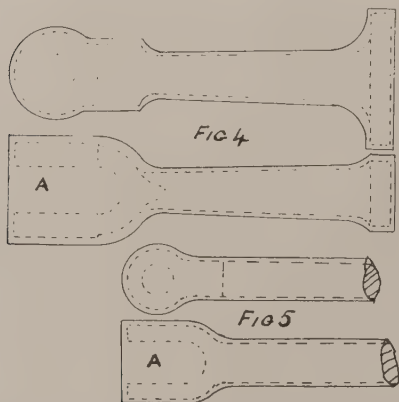
Diameter of driving wheels, $4\frac{1}{2}$ in.; diameter of bogey wheels, $2\frac{1}{2}$ in.; diameter of trailing wheels, $2\frac{1}{2}$ in.; gauge, $3\frac{1}{2}$ in.; length of side frames, 2 ft. 2 in.; width of bedplate, 6 in.; length of boiler barrel, including steambox, but not including length of firebox, $13\frac{1}{2}$ in.; diameter of boiler barrel, $1\frac{1}{2}$ in.; length of firebox, $5\frac{1}{2}$ in.; outside, 5 in.; inside, $4\frac{1}{2}$ in.; width of firebox, $3\frac{1}{2}$ in.; outside, $3\frac{1}{2}$ in.; inside, tubes, $3\frac{1}{2}$ in. brass tubes (outside diameter), about No. 20 gauge; thickness of boiler plates, 1-16th in. (copper); pressure up to 35 lb. would be safe. We are sorry we do not know where you can get further information on the subject of building a model from this engine.

[1007] **Wireless Telegraphy.** B. S. M. (Oxford) writes: (1) Could you kindly inform me how to fix up a system of wireless telegraphy between the top rooms of two houses, the distance between them being about 100 yards? I wish to use a Wimshurst machine for it. A sketch would greatly oblige. (2) Can the ordinary single needle instruments be used for signalling? (3) Should the large brass balls which are used be hollow or solid? (4) Would a Wimshurst machine with 12-in. plates be powerful? (5) Will you also be so kind as to tell me if you know of any materials of which I can make a graph that will produce copies of drawings, &c., with a finer definition than that of the ordinary graph composed of glycerine and glue?

(1) You will require for your purpose a delicate relay of about 250 ohms resistance, with the magnet and armature suspended vertically, so as to be very sensitive. The core of the lower electro-magnet should bear a little platinum stud, raised about 1-64th in. above the general surface of the core, and the armature should be furnished with a similar stud just facing it. These are to close the circuit with the bell battery and bell. (2) An ordinary single needle instrument will not do to receive the signals, since you can get deflections in one direction only. You must use either a printing Morse, or else a bell; the latter is preferable. The coherer should be placed in circuit with a single cell Leclanché or dry cell, and the fine wire of relay. Using the bell (which should stand directly over the coherer) with the hammer spark downward, you may solder to the little ball that strikes the bell a short length (about 1-in.) of No. 18 wire, reaching just to the top of coherer. This will act as an efficient decoherer, and will decohere simultaneously with the stroke of the bell. Working at a distance of 100 yards it will probably be advisable to attach two copper wires, one attached to the left hand terminal of coherer, and going to earth anywhere (through gas pipes, water pipes, &c.), and the other to the right hand terminal of coherer, about six ft. long, and pointing straight up to the sky, like a miniature lightning conductor. To use the Wimshurst for transmitting, you must just rig up a transmitter consisting of a wood

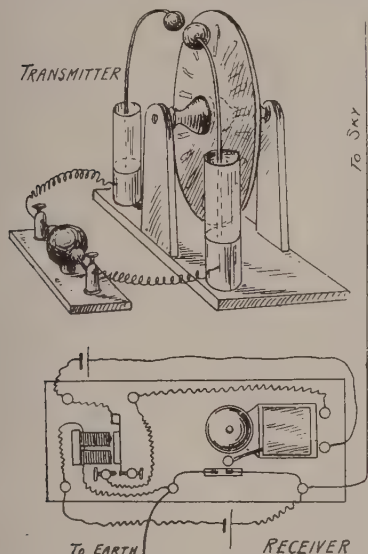


work, often makes a sad muddle when given a complicated drawing to work to. Make a rough wood pattern, if possible, and make it to the black sizes, then the smith can take sizes direct from it. If drawings must be sent,



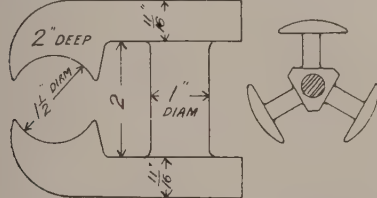
make plain rough sketches with dimensions of the forging on in bold figures. I have found it best in forge drawings never to put finished sizes, as it tempts the smith to cut down your allowance for machinery. Allow $\frac{1}{8}$ in. full to machine off, and 1-16th in. full for work to be filed up. Have all internal angles well rounded in forgings. Do not be guided by what your smith says about the advan-

base, about 9 in. by 3 in., in the centre of which should be a 2 in. brass ball, suspended on an ebonite stem, at the two sides of which are two 1 in. brass balls fastened to $\frac{1}{2}$ in. brass rods, running in two uprights also of ebonite, and capable of adjustment as to distance from the central ball. The Wimshurst should be connected to these two outer balls by two well insulated wires (gutta-percha covered) from the outsides of its jars, and the distances between the balls on the prime conductor and also those on the transmitter so



adjusted as to put them "in tune" with the receiver. Trial alone can determine the exact distance. About 1 in. between the main balls, and about $\frac{1}{2}$ in. between the transmitter balls will probably be found correct for 100 yards. Then the operator will rotate the handle of the Wimshurst, when he will find with a little practice that he can regulate the number and frequency of his discharges pretty accurately. Above is rough sketch of whole.

[1039] **Winding Small Dynamo.** R. W. (Bristol) writes: I have constructed a small motor and dynamo of the enclosed size. The field is wound with about 7 to 7½ ozs. No. 22 D.C.C. wire; armature laminated tripolar, 1½ in. by 1½ in. long; fields of ordinary cast-iron. The magnet is very powerful with any good cell on. Kindly state (1) best gauge of wire to wind armature with, so as to make it a good dynamo and run well as a motor. Small air-gap.



As it stands, the best you can do is to wind the armature with 2½ ozs. No. 20 silk-covered copper wire, and connect in shunt. Driven at 3,500 revolutions per minute, this ought to give about 3 amperes at 4 or 5 volts. If more wire can be got on armature, more 22 must be wound on F.M.'s at same proportion. As a motor, with three pint bichromate cells, the machine would take about 2 to 3 amperes at 6 volts.

[1033] **Faulty Dynamo.** "SMALL DYNAMO" (Highgate) writes: I should be much obliged if you could suggest through your correspondence column, anything you think is the matter with the dynamo I have made. Size of F.M., 4 in. high, 1½ in. wide, 1½ in. thick, wound with 1½ lb. No. 20 cotton-covered copper wire; armature, 1 in. diam., with ½-in. slot, 1½ in. long (laminated), wound with about 18 yards No. 24 S.C.C. When driven at a good rate it will not

even excite the F.M. I reckoned it to give about 3 amperes at 12 volts. The F.M. will lift about 6 lb. when connected with two bichromate cells. Is this strong enough, and should the armature be a fairly strong electro-magnet?

In the first place, the proportions of wire are wrong—1 lb. of No. 24 on F.M.'s, connected in shunt would be nearer the mark. Even at best, the dynamo could not be expected to give more than one ampere at 6 or 7 volts and needs to be driven at close upon 5000 revolutions per minute to do this. Try running in both directions at that speed. It is presumed that you have tested the machine for short circuit, that you have not reversed the armature winding, that connections of armature wire are properly made to commutator, that commutator space is not bridged by metallic particles, &c., as these are all simple faults, which can be easily tested and made good. Failing any such reason, it can only be presumed that the fault lies in the great inefficiency of so small a machine—perhaps aggravated by too much clearance between armature and pole-pieces. By connecting one pole of battery with one half of commutator, and second pole with second half, if all is well, the armature ought to exhibit a certain strength of magnetism, though not much. You do not say whether the dynamo is connected up in series or shunt.

[1067] **Permanent Magnets.** F. G. H. (Belfast) writes: (1) Up to what strength are permanent magnets made? (2) Where is the cheapest place to obtain same? (3) Is there anything that can be placed between a magnet and steel that will prevent it from attracting same, both being long less than ¼ in. apart? (4) Does it attract steel more than any other metal?

(1) Good permanent magnets should have a lifting power of about twenty times their own weight if of the horse-shoe form, and about four times their own weight if of the bar form. (2) We cannot specify any cheapest place to get permanent magnets; write to the various "electrical sundries" firms advertising in THE MODEL ENGINEER, mentioning the paper. (3) An iron screen will do what you want. The thickness would depend on strength of magnet, but for ordinary permanent magnets a sheet of soft iron, ½-in. thick, would be thoroughly effective. 4. No; the greatest amount of attraction is between the softest iron and the magnet. The harder the steel the less attraction there is; but, of course, the attraction of a magnet to steel is far greater than to other metals—such as nickel, cobalt, etc.

[1068] **½-in. Spark Coil.** T. H. C. (London, E.C.) writes: Will you kindly answer the following questions with regard to a ½-in. spark coil? (1) Dimensions. (2) Amount and size of wire for primary and secondary coils. (3) Number and size of tinfil sheets for condenser. (4) Number and size of iron wires for core. (5) About how much will the materials cost?

(1) For a ½-in. spark coil, the core should be 10 in. long by 1 in. diam., the bobbin 9½ in. long and 1 in. diam. ½ in. thick. The finished coil would be roughly about ¾ in. diam., this depends on the winding and insulation very largely. (2) For primary, two layers No. 18 cotton-covered soft copper wire, or rather under half a pound; secondary, 2 lb. No. 38 silk-covered soft copper wire. (3) Condenser, 10 sheets tinfil, 8 in. by 6 in. each. (4) No. 18 or 20 soft iron wires for core, probably about 250 being required of the first, or 500 of the second size. (5) The primary wire will cost about 2s. per lb. secondary (No. 38 S.C.C.) about 12s. per lb. Iron wire about 6d. per lb.

[1077] **Casting in Brass.** C. E. S. (Shrewsbury) writes: I have been trying lately to make some small brass castings, as described in the June number of THE MODEL ENGINEER, but with no success. The difficulty has been to get the sand in the two boxes to part satisfactorily. I used facing sand, compounded as directed, and for parting used very fine red sand, found on the river bank, and well tried. The bulk of the boxes was rammed with common sand. On separating the boxes, an irregular surface was always left, i.e., separation did not occur at the layer of parting sand. I tried the common and facing sands from almost dry to very damp, but with the same result. Possibly the parting sand is not satisfactory, and I am enclosing a specimen of it. I shall be very much obliged if you can tell me where I go wrong.

It is, of course, impossible to say exactly what is wrong with your moulds without actually seeing them. The following facts may, however, show the error or prove useful. In the first place, the sand in your boxes must not be too damp. To get this right take up a handful of sand and press it into a ball in the fist. Then open the hand. The ball of damp sand should be just dry enough for the ball to fall apart into several pieces with the slightest possible touch. The parting sand you enclose is excellent for your purpose, but it should be burnt before using. To do this, put some in an iron vessel and place in a hot fire so as to bring the whole to a white heat, or the burnt sand from the surface of a previous casting can be used. In any case, the parting sand should be used very dry, and the boxes not left together long enough for the damp to soak the parting too much. Failing all this, a parting may be tried by dusting thoroughly over the surface of the sand moulds with ordinary flour, using an old stocking from which the foot has been cut off and the two ends tied up with the flour in the middle.

[1080] **Repairing Accumulator Cell.** E. A. M. (Leeds) writes: I have an accumulator belonging to an electric scarf pin. I believe it is a 4-volt one. I find it is cracked about an inch down one side. Can it be repaired? It is the ordinary shape and style of pocket accumulator. The crack is very slight, but when full it

leaks a little. I am making the dynamo described in Nos. 2 and 3 of your valuable journal. Would this be capable of charging the accumulator?

Presuming the accumulator is in an ebionite case, it may be possible to repair the crack by holding a thin piece of red-hot iron close down along the crack until the edges are thoroughly softened, when they can be pressed together until cold. Another method would be to run a little paraffin wax along the crack, melting it into the hole by the hot iron, and painting afterwards with black paint. Other suggestions are to give several coats of indiarubber cement or varnish, or sealing-wax varnish, allowing each layer to harden before putting on another. (2) Yes; if the little dynamo be made with a tripolar armature, it would be well able to charge 4-volt small accumulator.

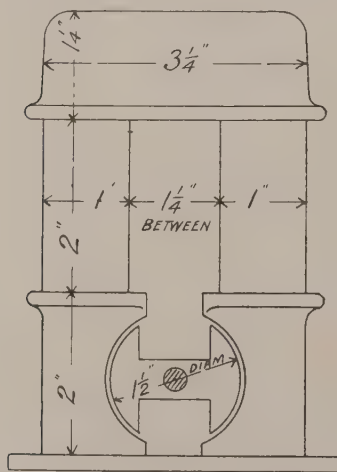
[1093] **Link Motion.** H. P. (Bristol) writes: Would you kindly explain, in your columns, the theory of the "link motion reversing gear"? I have noticed several, and should very much like to know its action.

The theory of the link reversing motion is not suitable for the "Queries and Replies" column in THE MODEL ENGINEER, as something in the nature of a treatise is required. We must refer you to our little book on "The Slide Valve," just issued at the price of 6d., in which the subject is pretty fully discussed.

[1096] **Bunsen Battery to Charge Accumulators.** M. E. H. (Newcastle-on-Tyne) writes: Would you please inform me what current is developed by two Bunsen cells? The resistance of each is 6 ohms, and the E.M.F. is 1.93 volts (approximately). How long would it take these cells to charge a 2-volt accumulator, size of plates (one positive and one negative), $\frac{3}{4}$ in. by $1\frac{1}{4}$ in.? Will it make any difference if the plates of the above accumulator were $\frac{3}{4}$ in. apart instead of $\frac{1}{2}$ in., as is recommended in your book, "Small Accumulators"?

The current developed by your two Bunsen cells may be calculated from the usual formula $C = \frac{E}{R}$, C being the current in amperes, E the E.M.F., and R the total resistance. This will give in this case $C = \frac{1.93 \times 2}{6 \times 2} = (\text{about}) 3\frac{1}{2}$ amperes, on short circuit. To charge a small 2-volt accumulator from this battery a resistance must be inserted in the circuit to bring the current down to about $\frac{1}{2}$ ampere. A small lamp taking that amount of current will suit admirably as resistance. The cell will be charged in about twenty minutes. The distance of $\frac{1}{2}$ in. between plates will slightly raise the resistance of cell, but will not very materially affect its working.

[1206] **Winding for Dynamo.** P. W. (Dublin) writes: Enclosed is a sketch of a dynamo. Please say what amount of and size of wire it will take to wind same; also what will be the probable output when shunt wound?



ARMATURE TUNNEL $2\frac{1}{2}$ LONG

Wind on the armature as much No. 24 s.c.c. wire as possible, probably about 4 oz. or a little over. The field-magnets must be wound with 12 lbs. No. 24 cotton-covered copper wire, and connected in shunt. The output would probably be 12 to 20 amperes at 10 to 12 volts, at about 3,300 revolutions.

[1116] **"Lord of the Isles."** C. C. C. (Hammersmith) writes: I am desirous of building a model of the G.W.R. Loco.

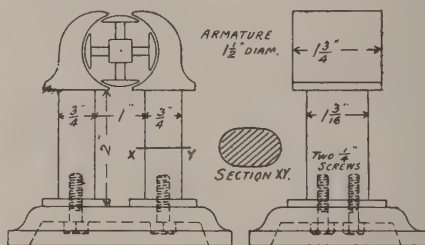
motive, "Lord of the Isles." Will you kindly give me, through your columns, dimensions of bedplate, boiler, cab, wheels, and funnel; also what size of cylinders would work it advantageously? My gauge between rails is $\frac{27}{8}$ of an inch. Will you kindly give length of engine and length of tender also? and I should like to know distance between centres of bogie wheels; and where I can get spring steel for the springs.

Bedplate: total length, 10 in., width, $\frac{3}{4}$ in.; boiler, 2 in. diam., barrel, $\frac{4}{3}$ in. long; firebox, $\frac{2}{3}$ in. wide outside, $\frac{2}{3}$ in. long; wheels: driving, $\frac{2}{3}$ in. diam., leading, intermediate and trailing, $\frac{1}{3}$ in. diam.; chimney, $\frac{1}{4}$ in. diam. outside, $\frac{1}{4}$ in. high. This will be a very small locomotive to work satisfactorily; probably cylinders, $\frac{1}{4}$ in. stroke by $\frac{1}{4}$ in. bore, will get the best results out of her, especially if they be oscillating. Total length of engine, 10 in.; tender, $\frac{6}{3}$ in. long. Wheel centres: centre of leading to centre of intermediate, 2 in.; centre of intermediate to centre of driving, 2 9/16ths; centre of driving to centre of trailing, $\frac{3}{4}$ in. For spring steel try any clock makers' supply house in Clerkenwell.

[1117] **The "Turbina."** L. H. M. (Maida Vale) writes: After hearing of the successes of the *Turbina* I have become very interested in steam turbines; and have often thought of making a model one. I rather wonder that no model maker has taken them up, or advertised castings of same for sale. Personally, I think a great number of your readers would be interested if you had an article dealing with them in your very interesting paper. Could you give me any information as to how to make one—say one to work a 4-ft. boat?

It is possible that something may be done in the future in the matter of a model steam turbine, but at present the difficulties of construction are such as to deter model makers spending valuable time over them for doubtful results. You will find full particulars and illustrations of Parson's reversing turbine in the "Scientific American Supplement," No. 1158, which you can see any day between 10 a.m. and 10 p.m. at the Patent Office Free Library, Bishop's Court, Chancery Lane, E.C. You can also study various sectional and other models of steam turbines (many of them working) at the South Kensington Museum, Science Collection. We should be only too glad to come across anyone who had made a successful model, and would be very pleased to publish details of same.

[1127] **Dynamo or Motor.** F. C. (Leeds) writes: I have attempted making patterns for a small motor, but it is without any theoretical calculations. I am, therefore, asking your advice about its correctness. The figures, I think, will be understood; I have made them as clear as possible. Please give me any errors you may possibly perceive. (1) Also sizes of wires for winding as a motor. (2) What alterations in patterns and sizes of wires for Dynamo about 10 or 12 volts.



The design sent is very good. Two alterations, however, would help the efficiency—the first being to thicken the base about $\frac{1}{8}$ in., and the second to make the cross section of cores thus  not . You will not need two screws to bolt the cores down, if they are screwed in tight. Wind armature in four sections with as much No. 24 s.c.c. wire as possible (about $\frac{1}{4}$ lb.—rather less). Use a 4-part commutator. Wind F.M.'s with $\frac{3}{4}$ lb. of same wire, and connect up in shunt. This will do equally well as dynamo or motor. As a dynamo the output should be about 2 amperes at from 12 to 15 volts.

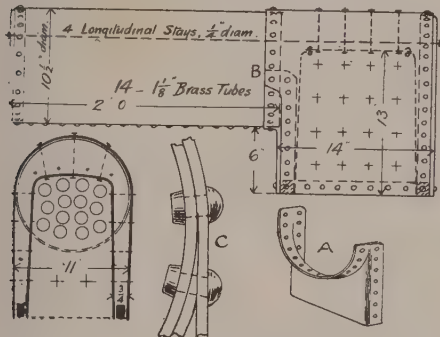
[1129] **Induction Coil Spark.** J. C. D. (Devonport) writes: Would you kindly state if there are any means whereby I could calculate the pressure at the secondary terminals of my induction coil, instead of using a voltmeter—say, by length of spark or otherwise?

It has been calculated that an inch spark in air requires a pressure of 50,000 volts, and so on in proportion. If your coil gives a 4-in. spark, the E.M.F. will be therefore 12,500 volts. Of course, at these high voltages you cannot have exact figures, but the above is as near as can be calculated.

[1130] **Loco. Type Boiler.** J. M. (Chorley) writes: Will you kindly say if the following dimensions of a loco. type of boiler will be proportionate? The firebox shell will be 11 in. wide. Will

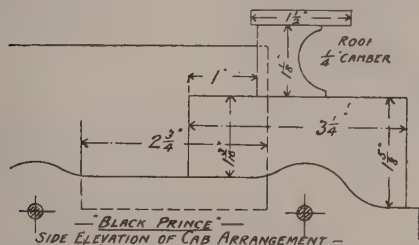
about 14 in. be the right length for the above width, and will the barrel be right about 24 in. long, and about $7\frac{1}{2}$ in. diam. on the outside? I am at a loss to know what height to put the inner firebox in order to get the right number of tubes in the diameter of same; and also what space there should be between them, and would you please say whether copper or brass ones would be the best? The shell plates are 7-32nds in. thick; the firebox, 1 in. (mild steel). What strength of girder stays ought I to put in, and how far from centre to centre? Would you also state the best method of jointing the barrel to firebox shell plate?

We give below a sketch of loco. type boiler, slightly modified from your dimensions. The only important alteration is in the diameter of boiler shell, which should be 10 $\frac{1}{2}$ in. diam. outside. This is necessary not only for correct proportion, but in order to make a good joint at firebox. As to that joint, the outside front firebox casing plate (which we sketch separately at A) is flanged as shown to be rivetted to boiler shell, half way round. The sides are flanged back the other way to be rivetted to side casing plates.



These are cut away at lower front edge, part being left to rivet round top half of boiler shell, but lapping the flange of front casing plate for a short space. At that spot (at B) the rivets will pass through three plates—viz., boiler shell, flange of front casing plate, and front edge of side casing plate. The flange of front casing plate (A) must be thinned down to make a good joint. This is shown at C, which is a rough section through boiler shell looking towards firebox. The cross section shown at left hand corner above is taken centrally and vertically through firebox. Dimensions are shown on general arrangement sketch for height of firebox, &c. The arrangement of tubes can easily be worked out in a full size sketch. They should be of brass, hard drawn. You do not mention the working pressure, but the brass tubes may be 3-32nds in. thick. Firebox copper stays will be about 3 in. apart each way, $\frac{1}{2}$ in. diam.; foundation ring, $\frac{1}{2}$ in. thick, $\frac{3}{8}$ in. high, best made a brass casting; ditto firehole ring: firehole oval, 4 in. by 3 in. Such a boiler should stand a working pressure of 120 lb.

[1134] L.N.W.R. "Black Prince." J. H. T. (Hulme) writes: Will you kindly forward me full particulars as to relative sizes of boiler, cylinders, cab, funnel, wheels, smokebox, &c., for model of L. & N.W.R. Company's new four cylinder compound, "Black Prince." I want the model to be able to travel at a good speed, and to be able to draw a complete model of the West Coast corridor train—five coaches. The engine must not exceed 12 in. in length. Also state size of firebox, and diameter of tubes to use through the boiler. Give gauge of rails.



Dimensions for model of "Black Prince"—boiler, 2 in. diam.; barrel, 4 $\frac{1}{2}$ in. long; firebox, 2 $\frac{1}{2}$ in. long, 1 $\frac{1}{2}$ in. wide; chimney, $\frac{1}{2}$ in. diam. at bottom, $\frac{3}{8}$ in. bare at top, $\frac{1}{4}$ in. high; wheels (bogies), 1 $\frac{1}{2}$ in. diam. D. and T., 2 $\frac{1}{2}$ in. diam.; smokebox, 1 $\frac{1}{2}$ in. long,

slightly larger in diameter than boiler barrel. Get in three tubes as large diameter as possible (probably not more than $\frac{1}{2}$ in.). Gauge of rails, 2 in. Size of cylinders is a difficult question to decide upon. In your case, probably $\frac{1}{2}$ in. bore, 1 in. stroke (2) will give best results. We presume you do not want to make the engine actually a four-cylinder compound.

The Sheffield Branch of the Society of Model Engineers.

As we are going to press the following report comes to hand:—The usual monthly meeting of the above took place on May 11th, in the hall belonging to the Y.M.C.A. Mr. Shaw took the chair at 7.30. Owing to sickness several members were absent, but, still, a very fair number assembled. The enrolment of the new members first took place. The chairman then proposed that a question box should form a feature of all future meetings, into which queries should be placed for discussion. This was unanimously carried. When other business had been dealt with, Mr. Shaw announced his intention of reading a paper at the next meeting, entitled "Ills and Complaints of the Gas Engine: Their Cause and Cure." This is to be illustrated by means of sectional drawings, and as Mr. Shaw has just completed a $\frac{1}{2}$ b.h.p. gas-engine, it will no doubt be most interesting. The company then examined the various exhibits provided by the members, chief amongst which was the gas-engine above referred to. Mr. Skinner had brought with him a model of a vertical steam-engine and boiler suitable for driving a small dynamo. This was very much admired by all present. Mr. G. H. Rooke had also added a small dynamo of the Lahmeyer type. After the other exhibits had been seen, a discussion on the making of small gas engines took place. A most enjoyable evening was brought to a close soon after 10 o'clock. The next meeting will take place at the same place on June 8th, the chair to be taken at 7.30.

G. H. ROOKE, Hon. Sec.

Amateurs' Supplies.

[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.]

A Neat Pocket Voltmeter.

A very handy and compact voltmeter, which has some specially interesting features: is that made by Messrs. Pollard & Co., and named the New "Beez" Pocket Voltmeter. This is an instrument almost indispensable to the user of accumulators or primary batteries for ascertaining the condition of the charge in the former, or the state of the latter. The "Beez" Voltmeter is of the watch pattern, having a flexible connector, which terminates in a small block of metal with a projecting pin. Another block having a pin at one end and a slot screw at the other, is screwed into the underside of the voltmeter when this is required to be used, or the two connectors fit into one another to guard the points when the instrument has to be carried in the pocket. The voltmeter is made for six tensions, the lowest registering up to three, and the highest to 120 volts. A descriptive sheet will be sent to readers of THE MODEL ENGINEER for one stamp. Messrs. Pollard's address is 5, St. Nicholas Buildings, Newcastle-on-Tyne.

Mr. A. H. Avery's New Works.

Mr. Alfred H. Avery, formerly of Tenterden, Kent, informs us that, partly on account of the large growth of his business during the past year, which has necessitated extra room and plant, and partly to enable customers to inspect apparatus or to consult him personally, he has taken a much larger factory at Tunbridge Wells. This has been equipped throughout with new and modern machinery, most of it specially adapted to the particular work required to be done. In addition to the manufacture of his Lahmeyer dynamos and motors Mr. Avery proposes to add a department for accumulator charging and dynamo and motor testing. Radiography will also be a feature, and general engineering work from the smallest model upwards will receive attention. Amateurs interested in any branch of mechanical or electrical work are cordially invited to call. The new address is Fulmen Works, Park Street, Tunbridge Wells, where, in future, all communications should be addressed.

Batteries and Electrical Sundries.

Having occasion to visit the premises of Mr. A. Caplatzi, ir Chenies Street, Tottenham Court Road, recently, we were struck with the extent and variety of the apparatus in stock. Every kind of electrical and mechanical apparatus was in evidence, including some of the most interesting experimental parts. Indeed, a collection

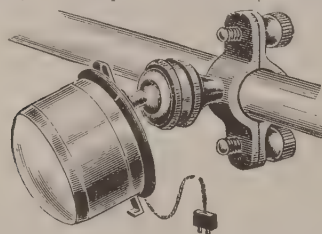
of old historical and experimental apparatus is one of Mr. Caplatz's strong points, as is also his stock of odd and out-of-the-way fittings of every description. Anyone in need of electrical or mechanical sundries, especially if these are of an unusual character, can be well assured that he will find something to suit his particular requirements at this firm. A prominent place is given to batteries and battery parts, and here every type of modern as well as half-forgotten electrical battery is represented, complete or in detail, forming a very valuable and interesting collection. In this connection, we must remark upon a very concise and clearly written book on the subject of batteries, published by Mr. Caplatz at 6d. It is filled with battery lore as "an egg is full of meat." And all whose predilection is in this direction would do well to study this little book. Something of interest to every amateur—electrical, photographic, mechanical or physical—appears to be the motto adopted, and certainly the amateur who pays a visit to Chénies Street without a satisfactory result must be very hard to please. Lists (each in its separate department) are sent to our readers for 2d. each, or four for 6d.; in all, twelve lists are published by this firm.

New Design Marine Engine.

We have received from Mr. F. A. Thomassin, 24, Broadway, Streatham, a sample set of castings for a smart model marine engine. The complete set consists of some eighteen parts, including three steel shafts, and as the castings appear to be true, cleanly cast and close to finished sizes, comparatively little work should be required to fit up the engine. The cylinder, when finished, is $\frac{3}{8}$ in. bore $\times \frac{3}{4}$ in. stroke, and as the engine is of a simple and light design, ought to prove a serviceable little model capable of driving a steamer at a good rate. Accompanying the set of castings is a four-page sheet of practical instructions on fitting the parts together, with an illustration of the finished engine, and prices quoted for the machinery of any parts the amateur may find beyond his skill. Prices and all particulars will be sent to MODEL ENGINEER readers on application as above.

The "Andrew" Electric Lamp Fitting.

The accompanying illustration shows a useful contrivance sold by the Bristol Electric Safety Lamp Works, for the benefit of those who read or work in bed. The appliance, which is called the "Andrew" electric light fitting, consists of an adjustable clamp with a bell and socket joint, to which is fitted a holder to take a small electric reading lamp. The clamp is secured to the top rail of a bedstead,



and the lamp can then be set in any desired position by means of the universal joint. For invalids and all those who read in bed, the fitting should be invaluable, and no doubt our readers will be able to find other uses—such as for lighting a lathe or vice in the workshop—for the instrument. The same firm supply all kinds of small accumulators and portable electric lamps for various purposes, and readers who need anything in these lines would do well to write to the Bristol Electric Safety Lamp Works, 40, Great Smith Street, Westminster, London, S.W., for their illustrated catalogue.

Cheap Electric Bells.

We have received from Messrs. Lever Brothers, of 359, Lillie Road, Fulham, London, S.W., a sample of a particularly cheap line in electric bells. The bell we have received has a 2½ in. bell-metal gong, and a polished hard-wood case, having quite a well-finished appearance. The internal mechanism is of a neat and well-made type, and the bell rings well with a single dry battery. The price complete is rs. 4d. each, or 12s. per doz., and we understand that the firm have a stock of 500 ready for immediate delivery.

Catalogues Received.

J. M. Draper, Organette Works, Blackburn.—From this firm we have received a catalogue of organettes, mail-carts, tea and dinner services, jewellery, travelling bags, &c., all of which goods are supplied either for cash or on the easy payment plan. A very large selection of music is listed for use with the organettes, and judging by the testimonials published, these instruments appear to have given general satisfaction. The list will be sent, post free, on application, to all readers who mention THE MODEL ENGINEER.

Harry W. Cox, Ltd., 10, 11, and 28, Curstow Street, Chancery Lane, London, E.C.—What is probably the most complete, attractive, and recent catalogue of x-ray apparatus is that sent us by

Messrs. H. W. Cox, Ltd. Thoroughly well-printed and replete with illustrations, this list will be of the utmost value to all the vast army of those interested in this alluring subject, from the beginner to the experienced worker. Every type of instrument, and all accessories, are quoted and illustrated, and many special forms of apparatus, designed and patented by the firm, are here to be found. It is claimed, and the claim appears perfectly just, that the goods turned out by Messrs. Cox are not only of the very best English workmanship, but that they are supplied at prices which compare favourably even with the cheap foreign makes. As a matter of fact, a written guarantee is given with every article sold. An interesting feature of this catalogue is a very excellent treatise most clearly and explicitly written on the subject of x-ray apparatus and the way to use it. The coil, its construction, connections, and method of working, all come in for consideration, and the explanation is helped out by useful illustrations and diagrams. Several x-ray pictures are reproduced. Although a catalogue primarily of apparatus for this class of work, Messrs. Cox wish it to be understood that their business is that of manufacturing electricians. Some other items of interest enumerated are wireless telegraphy apparatus, telephone instruments, Wimshurst machines, dynamos, &c. As showing that the list is thoroughly up-to-date, we may mention that the new electrolytic current interrupter of Dr. Wehnelt, which has just created so much interest amongst coil users, is here illustrated and priced. Readers likely to require any of the special apparatus manufactured by the firm, should send a stamp for this excellent catalogue.

D. F. Laing & Co., 47, South Portland Street, and Norfolk Street, Glasgow.—Messrs. Laing & Co. send us one of their very neat and useful catalogues of telephone apparatus supplied by them. The value of this list is much enhanced by a set of carefully worded instructions as to the fitting and installation of the instruments, and much clear advice regarding the likely faults, and how to deal with them effectively. At the same time, the various sets of apparatus listed are carefully arranged and plainly described so that customers can see at a glance the particular set best suited to their own requirements. In addition, several pages are devoted to estimates for indoor systems and outdoor lines, including the supply, erection, and upkeep of the installation. This little catalogue is well worth the two stamps for which any reader may obtain it.

F. H. Burrage & Co., 36, Station Road, Redhill, Surrey.—A useful catalogue of electric bells, indicators, telephone, batteries, engines, dynamos, and acetylene gas generators and fittings, is that sent out by the above firm. The latter forms a speciality, although it is announced that the special catalogue devoted to acetylene fittings is not yet quite ready. Another important feature is the second-hand machinery market, where amateurs may get bargains in slightly soiled models, etc. It is very rightly pointed out that many articles made for some special purpose, such as for exhibition, and used but once or twice, are practically as good as new, but at a greatly reduced price. Many amateurs will find this department of considerable use. The catalogue under notice, which is fully illustrated, is issued at 2d. Readers should mention THE MODEL ENGINEER when corresponding.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 3s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertising Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All correspondence relating to advertisements to be addressed to the ADVERTISING MANAGER, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All subscriptions and correspondence relating to sales of the paper to be addressed to the publishers, Dawbarn & Ward, Limited, 6, Farringdon Avenue, London, E.C.

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THE
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AND
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EDITED BY PERCIVAL MARSHALL. A.I.MECH.E.

VOL. II. No. 18.

JULY, 1899.

PUBLISHED
MONTHLY.

A Model Electric Motor-Car.

By G. H. ROOKE.

[The following article was awarded the prize of £2 2s. in our recent competition.—ED., M.E.]

ABOUT nine months ago a description of an electric car I had constructed appeared in these pages.

The model was driven by a battery some distance from the track, the electricity being conveyed through the rails. In a footnote to the article, the Editor pointed out the advantages of having the battery apart from the car, and added that many of his correspondents had endeavoured to make models which carried their own motive power, but that owing to the great weight of the battery, hitherto without success. I therefore set out to see if it could not possibly be done, and am glad to say that I have just finished such a car, which is in every way satisfactory. My model electric motor-car runs for four to five hours at one charge, and can be adjusted to either run in a straight line or in a circle. Its over-all dimensions are 14 ins. long, 12 ins. high, and 6½ ins. wide.

The body of the car is of sheet ebonite, that material being chosen for the sake of appearance, lightness, and

strength; the base of mahogany; the wheels of brass, with indiarubber tyres. The weight of car without battery is 8½ lb. The accumulators are conveyed in the boxed-in portion placed at the rear. The car is provided with two small electric lamps in front, which can be switched on or off at pleasure. The switches, of which there are two in number, are on each side of the steerman's seat. The entire model took me about five months, of spare time, to construct.

The Motor.—This is one of those splendid little machines designed by Mr. Avery. I find that this gentleman has anticipated me and given a full and clear account of its construction in the March number of **THE MODEL ENGINEER**. The only addition necessary for me to make is the mode of securing the motor to the under side of the car. Drill and tap two 3 16ths in. holes in the top side of the carcase for two cheese-headed screws 1½ ins. long. These screws pass through the base of the car and hold the motor firmly in position.

Gearing.—This is done by means of a worm and worm-wheel. The cost of these—which should be obtained at the same time as the castings for motor—only 2s. 6d. I

mention this, because if the amateur orders them from the nearest wheel-cutter, he will probably have to pay much



MR. ROOKE'S MODEL ELECTRIC MOTOR-CAR.

more. The worm is soldered firmly on to the projecting end of the spindle, and, of course, this must be done after the motor has been made to run, and also with the brass bearing in its place, as, of course, the latter could not be slipped over the worm. The worm-wheel is fastened to the centre of the front axle as explained further on.

The Base.—This is made from a piece of mahogany cut to size and shape of Fig. 1. Chamfer off the front edge on the top side.

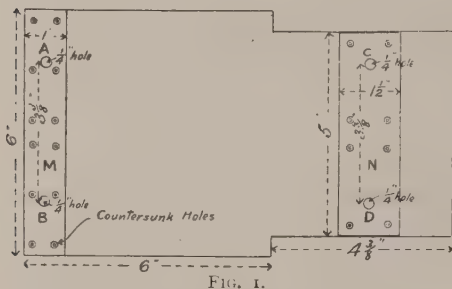


FIG. 1.

Bearings and standards of front wheels.—Cut off a piece of brass sheet $\frac{1}{8}$ in. thick, 6 ins. long, and 1 in. broad (M). Drill and countersink holes as shown (Fig. 1) for screws to secure it to base. Scribe a line down centre, and drill on it, $3\frac{3}{8}$ ins. apart, two $\frac{1}{4}$ in. holes at equal distances from the ends, as seen at A and B. Turn up, from $\frac{5}{16}$ in. brass rod, two standards $1\frac{7}{8}$ ins. long to shape given in Fig. 2. The flat portions must be cut out with a fine hack saw, and then filed up flat. In the side of these flat portions drill a $3\text{-}16$ ths ins. hole (E) to form the bearings. Now cut exactly through this hole with fine saw, having first drilled and tapped two holes to take two small screws (s s, Fig. 2). Fasten the two pieces together, and rimer the hole (E) back to $3\text{-}16$ ths in. again, as the

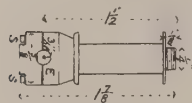


FIG. 2.



FIG. 3.

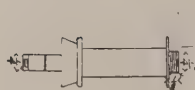


FIG. 5.

metal taken out by the saw will have reduced it somewhat. Run a thread on the projecting end, and tap the $\frac{1}{4}$ in. holes in the brass plate with the same thread. Treat both bearings alike, and then screw them into the $\frac{1}{4}$ in. tapped holes, making sure that the holes through which the axle goes are in one straight line.

Bearings and standards of back wheels.—The back wheels, being placed on a pivot, in order to run in a circle or straight line as may be desired, are a little more difficult. First cut a piece of brass sheet, $\frac{1}{8}$ in. thick, 5 ins. long, by $1\frac{1}{2}$ in. broad (N), drill and countersink holes to fasten it to base; then scribe a line down centre, and on it drill two $\frac{1}{4}$ in. holes, $3\frac{3}{8}$ ins. apart, and $13\text{-}16$ ths in. from each end, as at C D, Fig. 1. Turn up from $\frac{5}{16}$ in. brass rod two studs, as shown in Fig. 3. Run a thread on the $\frac{1}{4}$ in. projection, and tap holes C and D to suit. Screw in these studs into the holes, and make

them still more firm by sweating solder into the joints. This should also have been done in the joints of the front standards. The pivot rings (Fig. 4) are turned from $\frac{1}{8}$ in. brass sheet, and should be $3\frac{3}{4}$ ins. outside diameter, 3 ins. inside diameter, thus leaving a breadth of $\frac{3}{8}$ in. The spaces must be cut out with a fretsaw, and filed up, leaving a central portion 1 in. in diameter, containing a $\frac{1}{4}$ in. hole for bolt. Both rings should be exactly alike. Now make or procure a small bolt, $\frac{1}{2}$ in. long by $\frac{1}{4}$ in. thick, and solder this into the central hole of that ring which is to be the upper one. Through this same ring drill two $3\text{-}16$ ths in. holes exactly diametrically opposite each other. Insert the $3\text{-}16$ ths in. ends of the studs into these holes, and firmly sweat them there, making sure that the tail of the bolt is pointing downwards when the brass strip is screwed to the base. In other words, the studs project on one surface of the ring, the bolt on the other. The bearings are made from $\frac{1}{4}$ in. sheet brass, cut out to dimensions given in Fig. 5. Scribe two lines, and where they meet drill a $5\text{-}16$ ths in. hole. Cut across this hole

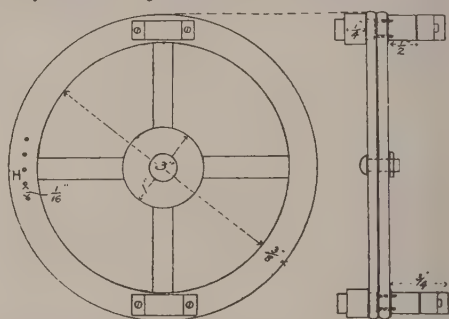


FIG. 4.

with fine saw, but before doing so drill and tap two $\frac{1}{4}$ in. holes through the thickness of the brass, as shown in Fig. 5 at S S. As before, screw the two halves together, and rimer back to $5\text{-}16$ ths in. Now solder these bearings on to the second ring, being careful to get the holes in a straight line, and the bearings themselves exactly diametrically opposite. To make them doubly secure, drill two holes from other side of ring into each bearing, tap them, and having run a similar thread on a piece of brass wire, screw it into the holes and file off flush. Now drill five small holes, $1\text{-}16$ th in. apart, in that portion of bottom ring which is to be at the rear of the car. (These holes are shown at H, Fig. 4.) By means of the central bolt and nut clamp both rings together in the position they will occupy when car is running in a straight line. Place the drill in the centre hole of the five, and drill a hole through the upper ring. It will now be seen that a small brass pin can be dropped through the one hole into either of the other five, thus fixing them in any position; the head of the pin prevents it from dropping right through. Thus, if the car has to travel in a straight line, the pin is placed in the centre hole; if in a circle, in one of the others, according to the size of the circle it has to travel in and according to the direction, left or right, as may be.

(To be continued.)

ERRATUM.—We have to correct an error which crept into the article in the June issue, "My Model Electric Cargo Boat, *Magnetic*." The dimensions given on p. 116, lines 4 and 5, should read "2 ft. 7 ins. by $4\frac{1}{2}$ ins. by $4\frac{1}{2}$ in." not $4\frac{1}{2}$ ft. as printed.

Two Useful Additions to a Screw-cutting Lathe.

By C. E. S.

PART I.—A SLOW SLIDING FEED MOTION.

DOUTLESS many readers of THE MODEL ENGINEER, like myself, possess a small screw-cutting and self-acting sliding lathe, and have felt that the tool is deficient in two respects—viz., first, an automatic sliding feed sufficiently slow to turn out work highly finished from the tool; and secondly, a self-acting surfacing feed. These two deficiencies I have been able to meet, at a very small outlay, by contrivances of a simple nature, and the result has amply repaid the time bestowed upon the work.

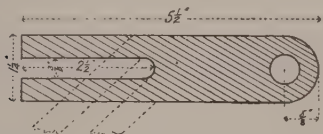


FIG. 1.

My lathe—a Britannia Company's No. 14—has $3\frac{1}{2}$ in. centres, and 3 ft. 6 in. gap bed, with leading screw $\frac{1}{4}$ in. pitch, and change wheels rising by five teeth from 20 to 100, with a 21, 22, 23, 24, and an extra 40. The wheels used for sliding are: on the mandrel 20, gearing with 95 on the stud, and 25 on the stud gearing with 100 on the leading screw. As the leading screw is of $\frac{1}{4}$ in.

pitch, this gives $\frac{20 \times 25}{95 \times 100 \times 4} = \frac{1}{76}$, that is, a feed of 1.76th-in. per turn of the mandrel. With this I find it impossible to turn a really finished surface, and I propose describing how I obtain a feed of about one-half that amount, giving a finish from the tool as bright as a looking-glass. The dimensions stated will be the same as used on my lathe, but they can easily be altered to suit one of a different size. The means employed are an extra wheel and pinion, mounted on a stud at one end of an iron arm slotted at the other end for the purpose of adjustment and fixing it to the wheelplate by a bolt and nut. The original stud is put at the outer extremity of the upper slot of the wheelplate, and the arm which bears the extra stud is attached to a convenient place on the lower slot of the wheelplate. The wheels used are as follows:—On the mandrel 20, gearing with 75 on the

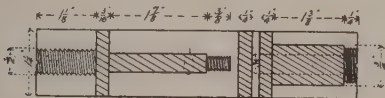


FIG. 2.

first stud; 25 on the same stud, gearing with 100 on the extra stud, and 40 on the latter, gearing with 90 on the leading screw. That is $\frac{20 \times 25 \times 40}{75 \times 100 \times 90 \times 4} = \frac{1}{135}$.

The materials needed are, a good piece of round iron rod, $1\frac{1}{2}$ ins. in diameter and 6 ins. long, and another piece 1 in. in diameter and 2 ins. long; also a piece of flat iron, $1\frac{1}{2}$ ins. by $\frac{3}{8}$ in. and $5\frac{1}{2}$ ins. long, two nuts and a washer. The cost will not exceed a few pence.

Take first the piece of flat iron, and file one end square, and then cut a slot up the centre of it $2\frac{1}{2}$ ins. long and

$\frac{3}{8}$ in. broad. Do this by drilling a hole at the extremity of the slot, and working up to it on each side with a hacksaw, and finishing with flat and round files. File the other end of the bar semi-circular, and $\frac{3}{8}$ in. from the extremity drill a hole and tap to $\frac{1}{2}$ in. This piece forms the arm which carries the extra stud, and is shown in Fig. 1 by the full lines; the dotted lines will be explained later. Next make centres at each end of the round bar, $1\frac{1}{4}$ ins. in diameter, and mount it in the lathe, and turn it true all over, removing as little metal as possible. Out of this piece are to be made the stud and sleeve, as shown in Fig. 2. The latter, shown at the right hand end of the figure, should be made first. If a suitable boring collar, with a hole not less than $\frac{3}{4}$ in. diameter, is at hand, or can be extemporised, turn down about $\frac{1}{2}$ in. of one end of the bar, while running between centres to fit, and then replace back centre by boring collar. Choose a drill of about $\frac{3}{8}$ in. diameter, and bore up the centre of the iron bar $1\frac{1}{2}$ ins., feeding in the drill with the back centre, and using plenty of oil. If the drill be carefully started, a true central hole will result. Before re-making the collar, turn the outer end of the hole conical to fit the back centre; take off the collar, and bring up the centre. Turn the sleeve to the dimensions given in Fig. 2, i.e., to match the original sleeve, making the end for a quarter of an inch of slightly reduced diameter, and cutting a thread upon it. Then, with a parting tool, cut off the piece, mount it in a jaw chuck, and face up the end just parted to gauge.

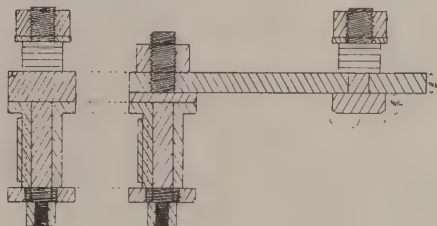


FIG. 3.

If a boring collar is not used, a piece of the metal of sufficient length to make the sleeve must be parted and put in a jaw chuck, and drilled through as described, and then turned up between centres.

Having completed the sleeve, make a fresh centre in the iron, and part a piece $\frac{1}{2}$ in. long. Mount this in a jaw chuck, face, drill through, and cut a thread in it to fit on the screwed end of the sleeve.

Again centre the piece of iron, and put it between centres to form the stud, as shown in Fig. 2. Turn down $1\frac{1}{2}$ in. of its length to $\frac{1}{2}$ in. diameter, and cut a $\frac{1}{2}$ -in. thread upon it to fit the screw at the end of the slotted arm. Reverse the work in the centres after placing a nut on the screw just cut and fixing a carrier to this, so that the thread may not be injured. Leave a flange next to the screw, 3.16ths in. broad, which with the thickness ($\frac{3}{8}$ in.) of the slotted arm, upon which it will lie, will be equal to the breadth (9.16ths in.) of the flange of the original stud. Turn down the rest of the iron to nicely fit the hole in the sleeve, and reduce the end portion to a slightly smaller diameter, and cut a thread upon it to take a nut. The portion on which the sleeve revolves must be a shade longer than the latter, so that when the nut is screwed home the sleeve will revolve freely, but with very little end-shake. The threaded part should be about $\frac{3}{8}$ in. long, and the nut which screws on to it, circular in plan, with two flats filed upon it and of such a diameter that the nut on the end of the sleeve will pass easily over it.

Fig. 3, which shows the stud with the sleeve upon it fixed to the slotted arm, and also shows the original stud and sleeve, explains the above. The arm is to be fixed by the bolt shown at the left-hand end to one slot of the wheelplate, and the original stud is to be bolted to the other slot. Hence it follows that the flange of the new stud must be thinner than that of the old one to the extent of the thickness of the arm—viz., in order to bring the two sleeves into the same vertical plane.

Next mount between centres the piece of iron, 1 in. in diameter, to form the fixing bolt, which is shown in position on the slotted arm in Fig. 3. The construction is clear from the figures. The head should be left the full size of the iron, and the neck made to fit easily into the slot of the arm, and the next is a counterpart of the base of the original stud, since both are attached to the wheelplate. The threaded part is fitted with a washer and a $\frac{1}{2}$ in. nut.

The groove must be cut along the body of the sleeve to take the feather, which fits into the slots of the change wheels. This may be done with a narrow chisel without hammering, using the tool in the same manner as in paring wood, the sleeve being fixed in a wooden vice by its ends. It is a tedious job, but quicker than filing. If the lathe possess an overhead and revolving cutter, it is, of course, much swifter to cut the groove with their help. The feather may be filed from any suitable piece of iron, such as part of a flat nail, and should fit the groove tightly and be fixed in position with solder.

Screw the stud into the slotted arm and put on a binding nut; fix the sleeve on the stud and the apparatus is ready for use. The wheels which I use on my lathe have already been stated, but in lathes of another make other combinations may be necessary, and it may also be necessary to make the slotted arm bent at an angle on the flat, as shown in the dotted lines in Fig. 1.

To set the wheels in gear, place the original stud at the outer extremity of the upper slot in the wheelplate, and mount the piston wheels upon it and upon the mandrel and leading screw. Revolve the wheelplate until the large wheel upon the stud engages with that on the mandrel; and then place the extra stud so that its wheels connect the motion of the original stud with that of the leading screw. As the extra wheels alter the direction of motion of the leading screw, it is necessary to introduce the reversing stud as used in cutting left-handed screws. Some time may be saved by making the stud and sleeve from forgings, or by building them up from different pieces of metal, but the method described is the one I employed and found very satisfactory and cheap.

For the Book-shelf.

[Any book reviewed under this heading can be obtained from THE MODEL ENGINEER Book Department, 6, Farringdon Avenue, London, E.C., by remitting the published price and cost of postage.]

MECHANICS APPLIED TO ENGINEERING. By JOHN GOODMAN, Wh. Sch., A.M.I.C.E., M.I.M.E. London: Longmans, Green & Co., 39, Paternoster Row, E.C. Price 7s. 6d. nett. Postage, 4d.; abroad, 8d.

An interesting comparison could be made between the modern method of teaching applied mechanics as exemplified in the book before us, and the style which did duty not so very many years ago. In those days a knowledge of the science of mechanics was laboriously obtained, and when mastered the unwieldy mass of theory seemed a long way from practical application. To judge from Professor Goodman's book, this has been so far altered that young

engineers no longer need to fear endless mathematical calculations, leading to no practical goal. In other words, while theory still maintains its important place in this work, it is theory "applied." The calculations are not those appertaining to impossible apparatus, but to the ordinary machines in common use, and the young engineer is clearly shown the theoretical reasons for many important points in machine design, with which he was probably acquainted, but had previously accepted without investigation of the underlying principles, because they were "the usual practice." The book contains over 600 pages and over 600 illustrations, and the subject is divided into eighteen chapters. The headings of these include mensuration, moments, mechanisms, dynamics of the steam engine, friction, stress, strain and elasticity, beams, bending moments, struts, torsion, hydraulic motors and machines, &c. It is obvious, on looking through the book, that, while the author has been thorough in his work, there is no indulging in the "wearisome diffuseness," which is too common a fault with text-books. Altogether, remembering that Professor Goodman's aim is to assist young engineers and students who have a fair knowledge of theoretical mechanics and elementary mathematics, the book should be highly successful. Its use can be specially recommended for those who intend to enter for such examinations as for the Associate Membership of the Institute of Civil Engineers, the B.Sc. and B.A. degrees in Engineering conferred by certain British universities, the advanced and honours stages of the Science and Art Department examinations, and the City and Guilds of London technological examination in mechanical engineering.

HOW TO BECOME A LOCOMOTIVE ENGINEER. By RANDAL McDONNELL. New Edition. London: Whitaker & Co., 2, White Hart Street, Paternoster Row, E.C. Price 1s. Postage 12d.

A chatty little book with a good deal of sound advice and practical information is this on "How to Become a Locomotive Engineer." There is clear evidence to show that the author has had experience in the shops himself, and is willing to impart instruction to beginners. The various stages of a young engineer's shop life are very clearly stated, from the moment when he first takes file in hand to the day when he is "out of his time"; indeed, the description of shop routine, hints on early rising, and the best way to get on, are the best part of the book. We should be glad to see included a properly-compiled list of locomotive factories throughout Great Britain, and if such a list included reliable information as to premiums for apprentices and pupils, number of employees, and so forth, the value of Mr. McDonnell's work would be very much enhanced.

REGISTER OF LOCOMOTIVES ON THE L. & N.W.R. Birmingham: The Holland Company, Cherry Street. 1899. Price 6d. Postage 1d.

To judge by the number of queries addressed to us on the subject of L. & N.W.R. locomotives, this little book ought to have a considerable amount of success. We can well imagine the difficulties attending the publication of such a work, and can, therefore, give the more ungrudging praise to the editor and publishers for the undertaking. It is, of course, impossible for us to check the two or three thousand figures quoted (every loco. on the "North-Western" being represented) but great care has evidently been devoted to the compilation. The Register includes a list of "named engines," and several blank pages for the loco. enthusiast—and THE MODEL ENGINEER numbers many such amongst its readers—to enter any new particulars from time to time. A very timely booklet indeed.

A Few Practical Hints on Working and Casting Aluminium.

By F. P. SPICER.

AS a material for model makers and amateurs, aluminium has both advantages and disadvantages. Amongst the former are:

- (1) Its low specific gravity, *i.e.*, 2.67, or one-third that of brass;
- (2) that it does not tarnish, or only very slightly, in the atmosphere;
- (3) that it does not become coated with verdigris if left oily, as does brass;
- (4) that it is not acted on, to any extent, by water (salt or fresh) like steel or iron.

The chief disadvantage is that it does not work up nicely, but, like copper, is too soft. This difficulty, however, is obviated, as with copper, by the use of an alloy, for aluminium varies in hardness according to its purity, the purest being the softest. A suitable alloy can, moreover, be obtained which will work much the same as brass, but which still retains a low specific gravity.

Pure aluminium of commerce contains about 99 per cent. aluminium, the impurities consisting of iron and silicon. I now give a few alloys, some of which have appeared in various engineering papers, the first two being those which I have chiefly used in my own model-making work:

(1)—Aluminium ...	70 per cent.
Zinc	25 "
Tin	5 "

This is a nice metal to work with, but is rather "short in the grain."

(2)—Aluminium ...	84 per cent.
Zinc	15 "
Copper	6 "
Tin	5 "

This is much the same as No. 1, but is stronger.

(3)—Aluminium ...	75.7 per cent.
Zinc	20 "
Copper	3 "
Manganese ...	1.3 "

This is one of the strongest alloys of this metal known, the tensile strength being 35,075 lb. per square inch, or equal to that of gunmetal, and specific gravity 3.117.

(4)—Aluminium ...	10 per cent.
Copper	90 "

This is generally known as aluminium bronze, the colour being that of Australian gold; melts at same temperature as gunmetal, can be forged at a red heat, may repeatedly be recast, has a tenacity of 44.6 tons. compression of 58 tons, and is sometimes used for springs, owing to its elasticity.

Pure aluminium melts at a temperature of 1157° F., while copper melts at 1920° F., and although it does not volatilise at this temperature (1157° F.) it is advisable not to heat much above the melting point, or to keep it melted longer than possible, as it oxidises quickly, thus wasting a considerable amount of metal at every reheating. With regard to the melting of this metal, I need say but little. Sufficient heat can be obtained in most ordinary kitchen ranges; or, if any reader wishes to build a furnace for himself, let him refer to the illustrated article which deals with this subject, as printed in the May and June issues of this paper in 1898. One important remark I must not omit, however—namely, that aluminium should be melted in a *plumbago* crucible and not in an ordinary fireclay one, as the metal absorbs silicon from latter, which causes it (Al.) to become brittle. The coefficient of linear expansion of pure aluminium is

.0000206° C., and to help the pattern maker I add that the contraction is 17-64ths ins., or a full $\frac{1}{4}$ in. per foot, which is more than the contraction of brass.

The best material for making the moulds in is ordinary moulding sand, which is moistened with water until it adheres when pressed in the hand, but care must be taken not to make the moulds too wet, or the castings will "blow." Owing to its low specific gravity, it is best to "run" the metal as near the bottom of the moulds as possible, thus allowing the heated air and gases to escape upwards. To get these away generally necessitates the use of a number of air holes in the mould, and the best way to make these is to press a knitting needle through the sand to touch the pattern before "parting" the boxes.

Owing to the low temperature of the melting point, it is unnecessary to face the moulds, and the metal should always be poured at as low a temperature as is consistent with the size of the casting, because on cooling, the metal, owing to contraction, sometimes cracks, and the casting should be allowed to cool slowly.

Cores, if any number are required alike, are best made of core sand in a box, but if only one is required, and that is not too intricate, bathbrick is the best material to use, as it gives such a fine surface to the cored parts.

If a sand core is used, it must have some airholes made in it, and, if it is too frail to be easily pierced with a wire, the following is perhaps the easiest way of proceeding. Procure a taper, and split it up into fibres about the thickness of twine, and as the box is rammed lay pieces of this material in the core, taking care that one end reaches right through to the part of core to be placed in core print. When the core is moulded, place it on a flat plate and allow it to be heated to a dull red over the fire. This burns all the wax and cotton fibre of the taper away, and leaves a passage for the air through the core. The cores should be placed in position, and the metal poured when the cores are hot.

Pure aluminium, as was stated in the January issue of THE MODEL ENGINEER, may be filed if turpentine is used as a lubricant, or it may be ground on a grindstone, but the alloys I have used work quite well without any lubricant at all. For turning in the lathe, the under side of the tool should be backed off 30 degs. from the vertical to get the best results. The metal is capable of taking a good finish if the proper form of tool is used.

A high polish can also be obtained by rotating the work at a great speed and pressing rough-surfaced paper, and finally smooth polished surfaced paper, against the article, or the work may be "buffed" with a felt "buffing" wheel.

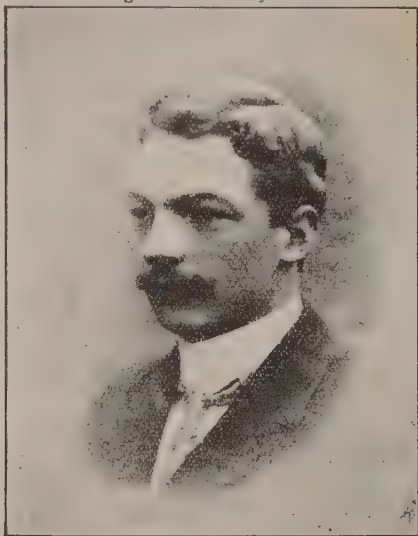
If "H.S.G." of Acton, whose query (No. 976) was replied to in the June issue, will send us his name and address, we shall be pleased to put him into communication with another reader who is willing to assist him with regard to the construction of a model G.N.R. loco.

In the smoking-room of the House of Commons Mr. William Allan, the Member for Gateshead, recently took the opportunity of exhibiting a model to scale of the water-tube boiler, as employed in the Royal Navy, with a view of demonstrating the defective circulation and consequent liability to explosion. The hon. member, who has had a life-long experience of marine engineering, showed by means of glass tubes heated by methylated spirit that the steam which is generated cannot get away without displacing the water and leaving a vacuum, which renders the tube liable to burning, and to consequent deterioration. The experiments, which were watched with interest by a considerable number of members, convinced Mr. Allan that a return to the old style of boilers in the Navy is desirable.

Some Models I Have Made.

By JAS. C. CREBBIN.

MY model-building career began at the age of 7, when I roughly built a model tug-boat. This had for a boiler a "Nestlé's Milk" tin, inside of which was fitted a piece of perforated zinc for a grate, and a funnel at the end. The fuel used for this (what was then to me a magnificent model) was smouldering oily waste, and by this means I obtained plenty of highly-scented smoke, which was the principal object required. I might add, that this model made many a successful trip on the River Lea to the great alarm of my relations.



MR. JAS. C. CREBBIN
(Vice-chairman of the Society of Model Engineers).

At the age of 15 I built my first locomotive, which had oscillating cylinders and a boiler fitted with water-tubes, but for some unexplained reason this model, or toy, was never a great success. My next model was a small steam launch, 2 ft. 3 ins. long, fitted with a double-action oscillating cylinder, $\frac{1}{2}$ in. by 1 in. stroke, and water-tube boiler. This model worked well, and made many a trip across the Round Pond, Kensington. It was afterwards sold for double its cost; a fact which I considered as very satisfactory evidence of its quality.

Another model I tried to build, after my launch, was an outside slide valve cylinder locomotive, but the boiler was very defective, and so disgusted was I with its performances that I disposed of it as soon as possible.

My next departure was a model cruiser, length over all 3 ft. 3 ins. It had a pair of slide valve cylinders, $\frac{3}{8}$ in. bore by $\frac{3}{4}$ in. stroke, and a water-tube boiler with a working pressure of 25 lb. per square inch. This model was a distinct success; but, owing to my living some distance from any water, it has never been finished in detail.

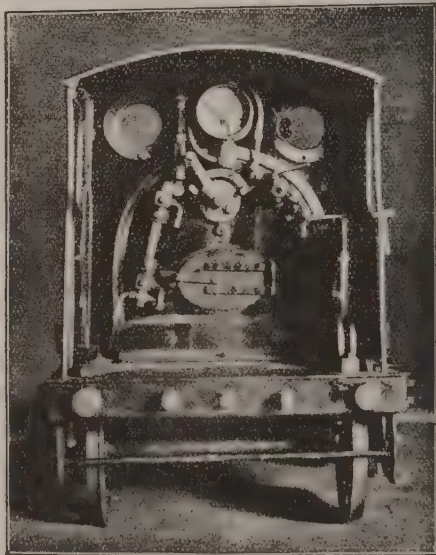
I then rebuilt two locomotives before I at last came into possession of the frame of No. 3 locomotive, as shown in the accompanying illustration. I started to make this in January, 1898, and have more or less been engaged upon it ever since.

It was made to no particular pattern, but may be classed as a modernised broad gauge "Pole Star." It has a double mild steel frame $\frac{1}{2}$ in. thick. By adopting this type of frame the necessity for the horn blocks for the axle-boxes, usual with a single frame, is done away with.

The cylinders were built up in a similar manner to Mr. Alcock's "Midland," described in the May number of THE MODEL ENGINEER, and are 1 in. bore by $1\frac{1}{2}$ in. stroke. The valve motion is of the Gooch type, as used on the G.W.R. broad gauge engines, and, although very complicated, cannot be recommended for efficiency in the distribution of steam.

The leading, driving, and trailing wheels are $2\frac{3}{4}$ ins., $5\frac{1}{4}$ ins., and $2\frac{3}{4}$ ins. diameter respectively. The springs of the driving wheels are fitted between the frames, but are so arranged as to allow the bearings only 1-16th in. practical movement. The bearings of the leading wheels are fitted with spiral springs, and those of the trailing with laminated springs which are built of watch spring 3-16ths in. wide, this type of spring being the best for quick action.

The boiler is built up of two parts—viz., the barrel and firebox casing—the former having a diameter of $3\frac{1}{2}$ ins., the latter being raised $\frac{1}{4}$ in. round the barrel. The inside firebox is $3\frac{3}{4}$ ins. long, $3\frac{1}{4}$ ins. wide, and 4 ins. high, and has 3-16ths in. water space. There is one large fire-tube, $1\frac{1}{4}$ ins. inside diameter, which is crossed by



MR. CREBBIN'S NO. 3 LOCOMOTIVE.
(INTERIOR OF CAB.)

ten water tubes, $\frac{1}{4}$ in. diameter. The firebox has two ribs, $\frac{1}{8}$ in. by 5-16ths inside, and twelve copper stays.

The smokebox consists of a piece of tube fitted over the barrel; it is flanged outwards so as to take the front plate. This makes a perfectly airtight chamber, and, consequently, a better draught is obtained. The funnel is 1 in. in diameter, $\frac{3}{4}$ in. of it being let into the smokebox, and is fitted with a ring blower. The fuel used is either coal, spirit, or oil; the latter producing the greatest quantity of steam, but also the greatest noise, which rather resembles the roar of a small waterfall. The prin-

cial fault about this boiler is the great height of the firebox in the barrel, which tends to make it prime somewhat; otherwise it is very successful, supplying the cylinders with plenty of steam, the steam gauge never falling below 10 lb. per square inch when running.

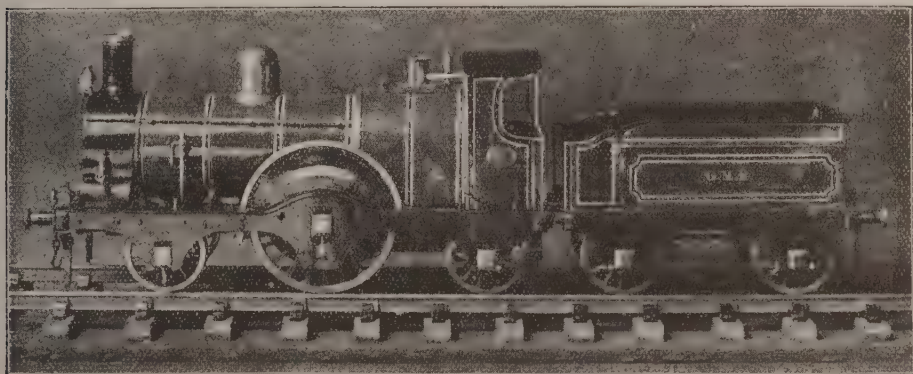
The tender is fitted with four wheels, $2\frac{1}{2}$ ins. in diameter, and has laminated springs fitted inside the frames. It contains a horseshoe water tank, spirit tanks placed on the top of the former, and an oil tank fitted between the wheels below the footplate. As to the working capabilities of the locomotive I can say little, as I have only just started to lay down a 100 ft. track; but it will run up a gravel track 1 in. in 20, which I consider very satisfactory. The "G.M.R.," of course, means Great Model Railway.

I am about, however, to build a larger boiler, to stand 40 lb. square inch working pressure, for the purpose of testing the "Vic" Injector, and I have no doubt that my No. 3 will then prove that she is not only smart in appearance, but also in performance.

The Society of Model Engineers.

THE usual monthly meeting of the Society of Model Engineers was held at the Leopold Rooms, 3, St. Bride Street, E.C., on Tuesday, June 6th, at 7 p.m., about thirty members and friends being present. Owing to the fact that only two names were handed in to compete for the prize offered by the committee for the "best verbal description of a home-made workshop appliance," it was moved and carried that the competition be held over. The chairman, Mr. Percival Marshall, then requested

Mr. W. BLANEY to describe the construction of a small launch engine he was exhibiting. Mr. Blaney explained that he had built this little engine to show what possibilities were to be got from the use of lead. The cylinder was constructed with a thin brass tube, round which the body of the cylinder and the bottom cover were cast in lead. All bearing surfaces were of brass, and the lead casting virtually finished the model. The engine



MR. CREBBIN'S No. 3 MODEL LOCOMOTIVE.

The principal dimensions of this engine, as illustrated, are as follows:—

Diameter of cylinders ...	1 in.
Stroke of pistons ...	$1\frac{1}{2}$ ins.
Diameter of driving wheels ...	$5\frac{1}{4}$ "
" leading " ...	$2\frac{3}{4}$ "
" trailing " ...	$2\frac{3}{8}$ "
Centre of leading to centre of driving	$5\frac{1}{2}$ "
" trailing " ...	$5\frac{1}{2}$ "
Total wheel base ...	11 "
Thickness of frames ...	$\frac{7}{8}$ "
Height to centre line of boiler	$5\frac{1}{2}$ "
" from rail to top of funnel	$9\frac{1}{4}$ "
Width of platform ...	6 "
Length of boiler (including firebox)	12 "
" (" and smoke-	
" box) ...	$13\frac{3}{4}$ "
Thickness of boiler plates ...	$\frac{1}{16}$ "
Heating surface—	
Firebox (including ribs) ...	84 sq. ins.
Tubes ...	57 " "
Total	141 " "
Area of fire grate ...	$12\frac{1}{4}$ " "
Wheel base of tender ...	6 ins.
Total length of engine and tender	over buffers, 2 ft.

6 ins.

worked well under steam. Mr. Blaney's description met with hearty acclamation.

Mr. H. HILDERSLEY was next called upon to describe the making of the slide-rest he had on exhibition. He first explained that his lathe was, originally, without back-gear or slide-rest. A large pulley was fitted to the mandrel working from a small wheel on crankshaft in order to get slow speed. A wooden slide-rest was then constructed, and patterns made of the various parts for the iron slide-rest. The castings were turned and bored by means of the wooden rest, very light cuts having to be taken. The screws were cut with dies. The result was a very satisfactory tool produced for very little expenditure indeed. Mr. Hildersley's skill was much applauded.

Several questions having been submitted to the meeting and answered, a general discussion was initiated by Mr. W. J. Tennant, who described a form of model "Geyser," designed to illustrate those curious natural hot-springs so common in Iceland. Other suggestions and descriptions of various engineering devices were contributed by Messrs. Marshall, Hildersley, Sanderson, and other members, the meeting being adjourned at 9.45.

The Secretary, Mr. H. Sanderson, desires to call the attention of members to the fact that many subscriptions are falling into arrears. Such amounts should be immediately forwarded in order that the books may be kept well up to date.

PROVINCIAL BRANCHES.

BRADFORD BRANCH.—The monthly meeting of this branch was held on Monday evening, June 5th, 1899, when there was a fair attendance. A model of a "Penn's Vertical Trunk Engine" was shown by Mr. J. H. Lamb, and Mr. Harry Firth showed a model of a "Horizontal Engine." Both were very much appreciated, as was the paper read by Mr. T. H. Wilson on "Small Tools, and How to Make Them." The next meeting will be held at the Central Coffee Tavern, Tyrell Street, Bradford, on Monday, July 3rd, 1899, at 7 p.m. All interested in model making will be welcome.—**JAMES II. LAMB** (Secretary) Holly Bank, 109, Rushton Road, Thornbury, Bradford.

SHEFFIELD.—The ordinary meeting of this branch took place on June 8th, in the Y.M.C.A. Mr. Shaw took the chair at 7.30, and, after formal business had been disposed of, the company viewed the exhibits provided. Mr. A. Skinner brought with him part of a model locomotive, the original of which is at present running on the G.N.R. Mr. Skinner also provided an oscillating vertical engine, which, by means of Mr. Shaw's air pump, was made to work splendidly. Mr. Stringfellow showed and explained a capital milling machine head, and Mr. Burrows and others provided some very interesting books on mechanical matters. A small shocking coil, a small armature, and a rotary electric engraver, were exhibited by Mr. G. H. Rooke. The vice-chairman now called upon Mr. Shaw to give his paper on "Complaints of a Gas-engine: Their Cause and Cure." The lecturer opened his paper with a brief description of the "Bischof" type of engine, which he explained by means of diagrams and illustrations. Passing through the various stages of the development the gas-engine has undergone, Mr. Shaw displayed a large, excellently made working sectional diagram. The various parts were shown in motion by means of gear-wheels placed behind. Each stroke of piston, and its accompanying action on the gases, were shown by means of a revolving coloured disc, working ingeniously in the cylinder. The lecturer, amongst the chief causes of failure, enumerated three as the principal—badly-fitting piston, leaky valves, and faulty ignition tube. He then described how these could be ascertained and then corrected. The proper position of the piston during the opening and closing of the valves was made very clear, as also was the method of obtaining the right mixture of gases. At the close of the lecture many questions were asked, which were dealt with in a clear and concise manner. A vote of thanks by Mr. G. H. Rooke terminated the proceedings. The next meeting will take place on July 14th, at eight o'clock.—**G. H. ROOKE**, Hon. Sec.

Special Excursion of the Society to Brighton.

IMPORTANT ANNOUNCEMENT.

THE July meeting of the Society of Model Engineers will be held on Saturday, July 8th, and will take the form of a whole-day trip to Brighton. We are pleased to be able to announce that Mr. R. J. Billinton, the locomotive superintendent of the L. B. and S. C. Railway, has very kindly consented to allow the members of the society to go through the company's locomotive works in the morning, while in the afternoon, the members will, through the courtesy of Dr. J. Bradbury Winter, have an opportunity of inspecting this gentleman's famous model locomotive, "Como," and also his private workshop which contains some special tools and other items of much interest. Members are requested to

meet at Victoria Station, L. B. and S. C. Railway, in good time to catch the train which leaves at 8.25 a.m. Those members who prefer to come from London Bridge station, can do so by the train which leaves at 8.30 a.m. The return fare is 3s. It is intended that the members have lunch together at a suitable hotel in the interval between the two visits. This will be arranged for at a moderate figure, which can be ascertained from the secretary beforehand. The return train leaves Brighton Central Station at 7.10 p.m.

A Proposal for a Model Engineer and Amateur Electrician's Club for the United States.

By A. A. WEISS.

THE writer has felt the need of a society, having for its aim—"To stimulate the advancement of model engineering with the ultimate end in view of widening the engineering knowledge of the members."

The realisation of this scheme would depend on the active co operation of a few interested persons who would meet to perfect an organisation. A well directed movement is certain to meet with success, as the numerous intelligent model engineers and electricians in the United States are certain to appreciate the advantages of united efforts.

The following skeleton of a plan is probably a good basis of operations:—The charter or parent club could be organised with New York City as its home. After enough members have been enlisted, convenient meeting rooms should be rented to form a central meeting-place for future operations. Branch societies would then be formed in the principal cities, all working on the same system. Libraries would be formed at the club rooms for consultation by the members, discussions on engineering matters would be maintained, and models would be submitted for inspection and discussion. All this, it is evident, would be of immense practical benefit to the members.

The point at present is the necessity that interested model engineers and electricians should meet together and organise a well directed move in above direction. A united, well directed, well sustained movement must of necessity have a successful result, from which the advantages to be derived will fully repay all trouble.

If interested parties will correspond with A. A. Weiss, Stirling, N.J., a preliminary meeting could be arranged in New York City. Mr. Percival Marshall has kindly offered the assistance of the columns of the *M. E. & A. E.* to aid the movement.

In a letter to the *Mechanical World*, a short time ago, Messrs. Newton, Bean & Mitchell describe a novel steam-engine they have made. To quote their own words:—"Our first design was a small single-acting engine, having one cylinder 2 ins. diameter, by 2 ins. stroke. Not being entirely satisfied with the working of this, we have lately designed a double-acting engine, having a cylinder 7 ins. diameter, by 15 ins. stroke, with an automatic valve at each end and an exhaust port in the middle, the piston being of sufficient depth that this exhaust port is just uncovered at the end of the stroke. The valves are opened by the compression in the cylinder, and closed by the passage of the steam itself. We have not yet run this engine under steam, but hope to do so before long."

Model Yachting Supplement.

Doings of the Clubs.

[The Editor will be glad if club members will keep him posted up in the latest items of news suitable for this column.]

MODEL-YACHTING is a pastime which evidently finds plenty of favour in the Royal Navy, and one of the ships wherein the enthusiasm is most keen is H.M.S. *Curacao*, as the reports which we have lately received will show. Mr. Behenna writes:—"I quite endorse the sentiments of Mr. Watson, Commodore of Plymouth Club, re measurement L. & S.A. Y.R.A. 6000 Rule. It develops a healthy type of boat, and allows the models to be of such *size* and *weight* as to be easily carried, or taken by rail, for inter-club competitions—vide 9 "20"-raters going to Plymouth from Fowey, Brixham, and Dartmouth, to sail for the West of England Challenge Cup. I shall preach this rule all round the coast of Great Britain wherever this ship goes. When at Ilfracombe next week, we intend sailing a race with Mr. Noble's model from Tenby, that gentleman coming over in a trawler, which I consider shows him to be an ardent 'model yachting.' It is rumoured we may go to the Channel in July or August, and, if so, shall be able to sail the clubs there."

The Paisley Model Yacht Club opened its 1899 season on the pond at Arkleston, on April 8th last, permission to use this water having been kindly granted by the proprietor, Mr. James Drybrough. This club is making very healthy progress, for it now has about fifty members and thirty-seven yachts, as against five members and two yachts when it first started some six years ago. The boats are all measured by the
$$\frac{\text{LWL} \times \text{SA}}{6000}$$
 Rule. A very successful system of handicapping has been inaugurated this year, which enables boats of different sizes to race together, except in the cup races, when the boats are divided into distinct classes. Races for the juvenile members of the club have also been included in the 1899 programme.

With further reference to the question of sail-making for the Swansea M.Y.C., as raised in our last issue, Mr. S. B. Cozens informs us that nearly all the Swansea members make their own sails.

On the fixture card of the Guernsey M.Y.C. we notice that the committee call special attention to Sailing Regulation No. 6, which reads as follows:—"In the starting of yachts for any prize no member, or other person appointed, be allowed to push his yacht, but on the starting signal being given, to let his yacht go fairly. No yacht shall be drawn or pushed, but is to be fairly turned on the other tack. Should any owner or starter infringe this rule, the officer shall at once protest against such conduct, and the offending yacht be thrown out of the race." The committee are most desirous of putting a stop to "punting" along the wall, whether in beating

or running. The fact that it has been found necessary to give such a prominent warning on this point makes it fairly evident that the practice, or mal-practice as we should prefer to call it, referred to above, has been indulged in pretty freely. If the offending members would consider their action from the purely sporting point of view, we think they would soon realise the error of their way. Every model yachtsman should make up his mind to "sail fair, win or lose."

The 1899 fixture card of the Surbiton M.Y.C. contains particulars of some forty-five races, the season extending from February 4th to November 25th. The club season ends on November 30th, so far as club prizes and challenge cups are concerned; but in December challenge cup ties and other undecided races are sailed off. Private matches and sweepstakes may also be sailed during that month. The sailing water is at the Home Park, Surbiton.

Mr. F. J. Tansley kindly sends us the following particulars of the Lowestoft M.Y.C.: "Mr. T. E. Thirtle has been re-elected Commodore for the year, and Mr. A. Thirtle continues as secretary. There are about twenty members, and a lively season expected. The subscription is 2s. per yacht, and this entitles the members to compete in any race for which his model is eligible. It is proposed to have an open regatta during the season. The Lowestoft Pond is one of the best in the kingdom and the members are always ready to give members of other clubs a hearty welcome. Model yachting has been carried on here since 1850. My father is the oldest living model yachtsman and introduced the loaded tiller for steering models over sixty years since. Particulars of rules, &c., can be obtained of Mr. A. Thirtle, secretary, High Street, Lowestoft. There is a commodious boat-house and a caretaker in attendance all day, and no other models are allowed on the pond during a race but members' yachts, giving the club boats every chance of fair racing and a clear course—an advantage not obtained elsewhere. Visitors will always find someone ready for a spin with them, and a match can be arranged at any time by communicating with the secretary. The size of the Lowestoft Pond is as follows: length, 125 yds.; breadth, 50 yds.; depth, about 18 in. at sides, 2 ft. 6 ins. in middle. The pond is situated on North Downs.

Mr. W. Cubbin (Queenstown) writes:—"Might I be allowed to suggest that an article on making a *papier-maché* model would be thankfully received by many? I have carved and built models, and would like now to make a paper model, but am unacquainted with details, and I know of others who would be glad of the same information. The *Yachtsman* some years ago gave an article, and promised to repeat it at a future date, but has not done so that I am aware of, though they have published several designs by the late Mr. Gordon, of Dublin, whose weights, &c., were for paper boats." We should be glad to hear from any reader who is able and willing to help our reader with the desired information.

We are indebted to Mr. Walter Wilson, the hon. secretary, for the following particulars of the Barrow-in-Furness Model Yacht Club. The club was established in 1891, and now has a membership of thirty, some of the members owning several boats in different classes. The sailing water is on the Ramsden Dock, which gives an up-and-down course of a mile, *i.e.*, half a mile each way. The record for the 30-raters for their course is 11 min. 15 secs., while for the 5-raters it is 15 min. There are four classes of boats—*viz.*, 5-, 10-, 20-, and 30-raters, the rating being calculated on the $\frac{LWL \times SA}{6000}$

Rule. There is a club boathouse, which accommodates about fifty boats. There are several cups and other prizes to be sailed for during the season. Altogether the Barrow-in-Furness M.Y.C. appears to be a very flourishing concern. We believe the committee would be glad to arrange some inter-club races, and the secretary would be glad to hear from other clubs on this point. His address is 6, Brown Street, Barrow-in-Furness.

In making their third annual report to the members, the office bearers of the Leith Model Yacht Club intimate that they have again to record the continued success of model yachting, and that the class held during the winter months for instruction in designing and building model yachts has contributed, in no small degree, to the popularity of an amusement which is a recreation and an education. They regret the lack of a suitable pond for sailing their matches on, and express their opinion that some active steps should be taken in this matter. The finances show a satisfactory balance in hand, and a very handsome array of prizes appear to have been awarded on the results of the 1898 races.

Our Model Yachting Prize Competitions.

MR. W. T. VINE'S MODEL YACHT "MILDRED."

THE *Mildred* was designed and built during the winter of 1895 by Mr. W. T. Vine, now secretary of the Highgate Model Yacht Club, and has been regularly sailed by him in all their matches since 1896. She is now sailing her fourth season, and up to the present has proved herself to be one of the fastest boats that has ever sailed our North London waters. She belongs to the 10-rater class, her principal dimensions being L.O.A., 54 ins., extreme breadth, 10¼ ins., draught, including bulb, 8¾ ins., freeboard, 2¼ ins., mainsail, 871 sq. ins., topsail, 210 ins., foretriangle, 345 ins., total, 1,426 ins.; with a L.W.L. of 42 ins. The mast is 56 ins. from deck to truck, and cutter-rigged. Her design has been most careful in bracing it up—double stays on each side, with topmast stays as well; good rigged spars being one of the main elements to success, and, consequently, *Mildred* has been well cared for in this respect. In a hard beat to wind, or on a dead run before the wind, she has yet to meet her superior, and now, with ten winning flags flying, she has brought her owner prizes to the value of over £15. She commenced the season by scoring the highest points in the first race for the 10-rater silver challenge cup, given by the H.M.Y.C. officers.

During her first season's racing (1896) she captured the "Ladies" first prize with 14 points, beating eight others; the first "Club" prize, sailed in four races, aggregate points with 42; the "Kingsley Challenge" prize, three races with 29 points. In 1897 the "Ladies" first prize with 13 points; the "Kingsley Challenge" prize with 33 points; and the second "Club" prize, four races with 26 points, but only sailed in two races in this contest.

By winning the "Kingsley Challenge" prize two years in succession a valuable work of art became the property of her owner.

In 1898 she again won the first "Club" prize, four races with 50 points; the "Freda Challenge" prize, three races with 34 points, given by the Secretary, who handed it over to Briton, Mr. Field, who made the next score; and the third "Ladies" prize, with four points, the latter race being sailed at Kensington Round Pond, with extra time allowance, and weeds collecting on her fins being a trouble to her speed. She has sailed in two inter-club matches with the New Highgate Sailing Club, running into the semi-final heat the first time, but on the second match taking premier honours. The four best boats in each club were chosen to sail. *Mildred* beat her opponent in every heat, and won the final against Mr. Ramden's *Ivanhoe*, their cup holder.



MR. W. T. VINE'S YACHT, "MILDRED."

The course at Highgate ponds usually sailed is 200 yds. long, varying from 80 yds. to 100 yds. wide. *Mildred* has been often timed while sailing this course, her quickest time being 2 mins. 3 secs. in a club match; but on a memorable occasion, with a strong south-west breeze, she ran the course under 2 mins., covering about 230 yds. of ground, or at the rate of four miles an hour. Altogether, *Mildred* has sailed in 22 club matches, and her record stands with 1, firsts, 6 seconds, and 2 thirds. Five other races have also been sailed, in which she has been first four times and once second—the total number of points in club matches being 245, or an average of just over eleven.

In our last issue we offered a prize of 10s. 6d. for the best article on the subject of "Model Yacht Measurement." After careful consideration of the competing essays, we have decided to award the prize to Mr. Chas. E. Hancock, 58, Claude Road, Cardiff, and have accordingly sent this reader a cheque for the amount

offered. The winning article will be published next month.

We are sorry to say that we have not had a single suggestion with regard to the proposed competition for the best design for a model sailing yacht. This looks remarkably as though the subject was one in which our yachting readers take no active interest. We sincerely hope that such is not the case, but we certainly shall not offer a prize unless there is some prospect of a fair number of entries being received.

Correspondence.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication. Communications should be written on one side of the paper only.]

An Open Competition for Model Sailing Yachts.

TO THE EDITOR OF *The Model Engineer*.

SIR,—A new model yacht will be put up for open competition by our club on July 29th next.

The date has been arranged to give competitors plenty of notice.

The model is a keel boat, 4 ft. over all, L.W.L. 39 ins. by 11 ins. by 9 ins. draft; displacement, 28 lb.; overhangs about 5 ins. each end. Of the displacement, 22½ lb. is lead keel. Largest sail area, 2,200 sq. ins. to 2,400 sq. ins. The boat has shown a very satisfactory turn of speed, and would suit most rules, L.W.L. class particularly. Fast in light and strong winds. Good all round, in fact.

The race will be held under Roath Park (Cardiff) M.Y.C. rules and measurement. This last is according to formula $\frac{L}{4} + (B + D \times 2)$ water-line measurements, for tonnage. Weight and S.A. free.

The course will be about 1¼ miles, and runs N. and S. Handicap about 40 seconds to the ton, according to the force and direction of the wind. In our club we do not give the same handicap in all weathers, but base it as nearly as possible on the time the race is likely to take, giving one second per minute per ton.

We shall be glad to see as many competitors as possible.

There is no entrance-fee. The models are handled from rowing boats, and this will give strangers to the pond a chance with those who know the water.

Could we count on seeing *Lady of the Lake* and others from Swansea? They will be well received, and can be confident of meeting worthy foes. Many of our models are of similar size to *Lady of the Lake*, ranging from 20 to 24 tons under our rule, but they are mostly keel boats.

If the entries from outside are sufficiently numerous, additional prizes will probably show in the race. If any open competition is got up by the Swansea under their own or any other rule, we shall, I know, find a boat or two to compete. We have not yet had the pleasure of trying conclusions with any of their boats.

Please excuse the length of this, but the opportunity offers of securing a trial of different club models under a rule which is very fair all round, and will put the sportsmanlike boasts of model yachtsmen to the test. The race will take place on our Roath Park Lake, which gives a course 600 yards long by about 200 wide.—Yours, etc.,

CHAS. E. HANCOCK,
Roath Park M.Y.C.

58, Claude Road, Cardiff.

Inter-Club Measurement Rule.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In answer to your letter of April 24th, I am very pleased to see a supplement on model yachting. I shall be only too pleased to forward you the doings of our club. Our secretary is going to forward you the dates of our fixtures for the year. We have in Guernsey one of the finest model yacht ponds in the United Kingdom. It was built expressly for model yachts. The dimensions are as follows:—350 ft. long, 160 ft. wide, 2 ft. 6 ins. deep. And I think we have some of the fastest models afloat. We have a very simple measurement as follows:—Greatest length over all added to greatest girth, divided by two, and allowing 10 per cent. off the whole for overhang.

Example:

L. O.	60
Girth	53
	113
Divide by 2	56½
Allow 10 per cent.	5½

51 Rating

Our first race takes place on May 25th at 2.30. All races are open to all comers, and anyone can enter five minutes from the start of the first race. There are five races take place every time we run, as follows:—30 rating and below 36 to 31-rating, from 42 to 37-rating, 54 to 43-rating, and one all-rating race. I will send you a full description of each race meeting.—Yours truly,

G. LIHOU.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I have been sailing models since 1885 in various parts of the world, racing local clubs whenever possible, and can endorse the remarks of Mr. A. Fordsmith, one of my models having raced under five different rules for rating.

In a copy of the *Model Yachtsman*, which made an ephemeral appearance about two years ago, there were no less than nineteen different systems of rating models noted against various clubs. Whilst agreeing that a common measurement rule would be most desirable, it seems to me that the following are grave obstacles to its development:

First, the difficulty of selecting the formula for measurement which would take many issues of your journal to discuss, arrange, and decide.

Secondly, the large number of good models under present club rules which might be out-classed when sailing under the new rule by craft built up to it.

I think the case might at present be met by each club having a time allowance scale for differences in rating under its own rule. This scale to be used when models are racing under the club auspices not built up to the club classes. Then it may be seen under which present rule the fastest all-round boat is produced, and what alterations are required to such a rule.

Boats built up to a sail and rule can always be provided with larger sails for light-weather competitions under rules taking no count thereof.—Yours faithfully,

O. F. GILLET, Commander, R.N.

"H.M.S. Crescent," North America.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I am sure all model yachtsmen will be highly pleased when they see the shape, form, and quantity of your "Model Yachting Supplement," and I hope they will have enough spirit to do all in their power to assist

you to make this a useful and paying feature of your journal. If they would help themselves to a good thing now is their chance, and they should come forward as subscribers, advertisers, and contributors of news as well as technical information. Plenty of good, healthy criticism will do the sport good and infuse fresh life into it; but let grumblers and carpers take a back seat, as they are only wet blankets to the enthusiasm and enjoyment of the many who can find pleasant recreation in building and sailing models.

My own opinion on your commencement is that it is A1, and my greatest regret is that I have so little time at command to help you. Having spent hundreds of pleasurable hours in the hobby of model building and racing, and got the benefit of its exercise for the mind, the hand and the body, I cannot take too high a view of the benefits it offers to a large number who want a hobby and a bit of quiet, healthful sport.

I cannot get much of it now, but I have a lively sense of gratitude for the effort you are making, and the opportunity you are giving others to make the sport once more popular. I congratulate you and those it is likely to benefit in this beginning in *THE MODEL ENGINEER* and hope it will go forward and grow into a substantial success. I see my friend Mr. Fordsmith has a kindly remembrance of my efforts when editing the *Model Yachtsman*, but on the point he suggests my advice, I will not at this time comment in any detail. I thoroughly agree with the advisability of having one rule for all the principal towns, and may have more to say on it after a time. At present, I must be brief and end with a general approval of what has, so far, been done.—Yours, etc.

Hull.

THOS. A. BRUCE.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I think the following is an impartial criticism of the proposals of your correspondents on this question in your June issue.

Mr. Watson speaks highly of the L. and S.A. measurement, but does not tell us which of the dimensions he quoted are most favoured by the members of his club. Neither does he state whether any visitor to Plymouth can get a sail with his club having a model which is not a 5-rater, 10-rater, or 20-rater under L. and S.A. rule. I presume his models are sailed "outside" in open water. Under these conditions the longer, lesser canvased boat may be best, whereas a boat for inland waters will probably be shorter and carry more sail. This is one weak spot in the L. and S.A. rule. A good model on one water may be out of it on the other.

"O.B." refers to a rule which appears simple enough, and invites all and sundry to compete together. Some 1730 boats would have a chance again.

Mr. Flockhart's rule is also simple, but lets the deep boat off. Beam is not taxed more than length. I surmise, therefore, that his members go in for something like

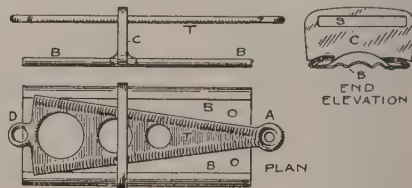
Mr. Richie, who gives the show away when he says that their favourite boats under a weight rule are not exceeding 17½ lb. displacement for a 48-in. water-line! I should call this a moderately light boat. He need not have added that they are broad beamed and carry a deep fin keel. We could fill that in ourselves. They are no doubt fast for their weight, but could not be fairly sailed against boats of other types under a weight rule any more than Mr. Watson's could under L. and S.A.—Yours, etc., Cardiff.

"SAIL TONS."

We shall be glad if our model yachting readers will kindly show this journal to any of their friends who may be interested in the mechanical or electrical articles which it contains.

Steering Gear for Model Sailing Yachts.

MR. G. R. SCOTT, who will be remembered as a winner in one of our recent yacht competitions, sends us a sample of his steering gear for model sailing yachts which has several points of interest. Its greatest claim is its simplicity, the appliance consisting of only three parts which could not easily get out of order. A reference to the accompanying illustration will explain the construction. The base B B consists of a thin piece of sheet brass pressed into the form shown in the end elevation, and having the two sides bent over to form guides for the sliding part C. This sliding cross piece is provided with a slot (S) through which works the triangular tiller-plate T. The sole plate B B is screwed down to the deck at the helm. One end (A) of the tiller-plate



is fixed to the helm post by means of a screwnut or by being soldered, so that the rudder stands true with the centre line of the tiller-plate. The sheet of boom is passed under the horse, and made fast to the hole at end (D) of tiller-plate. Now if the sliding part C be moved towards the end A of the sole-plate, it will be found that the tiller plate has a large range of movement right and left. When, however, C is moved to the other end, the rudder will be practically fixed centrally. When the boom goes over, if C be at one end, the rudder will be carried over with it; if C be at the other end, however, the rudder will be unaffected, so that by adjusting C, any desired amount of travel may be given to the rudder. We are informed that these steering gears have become very popular on the ponds in the West of Scotland. Mr. Scott, whose address is 13, Newmarket Street, Ayr, will send the appliance to any reader for 2s. post free.

Manchester M.Y.C.—The third race of the season, a tournament for 15 raters, was sailed off on May 6th on the club water at Levenshulme. The weather was bright and favourable, with a steady east wind, making the course a run out and beat to windward home. Seven boats entered, and, after a close race, *Titania* and *Enegu* scored even points; the deciding course resulting in a win for *Titania*; *Enegu* taking second, and *Dolphin* third prizes.

Model Yacht Sailing Association, Kensington Gardens, W.—The matches for the De Quincey Challenge Cup were sailed between the Surbiton Model Yacht Club and the Model Yacht Sailing Association. The first took place on Easter Monday, when the M.Y.S.A. won by 3½ points to 33½. The second match was sailed on the Surbiton water, on Whit Monday. Scores:—M.Y.S.A.—*Thistle*, Mr. T. H. Willey, 24 points; *Tottie*, Mr. J. E. Odgers, 20 points. S.M.Y.C.—*Ruby*, Mr. Pay, 4 points; *Viola*, Rev. Low, 0 points. The M.Y.S.A. won by 44 points to 4 points, and hold the challenge cup for this year. *Thistle* was sailed by Mr. Willey and Mr. G. Gaith (Hon. Sec. M.Y.S.A.), and *Tottie* by Mr. Odgers and Mr. Braine. The officers of the day were Mr. S. J. Howe (M.Y.S.A.), and Mr. Lambert (S.M.Y.C.).

The Edinburgh and Leith Model Yachting Club.

THE "McLENNAN" CHALLENGE CUP.

THROUGH the courtesy of the secretary of the Edinburgh and Leith Model Yachting Club, we are enabled to present to our readers the accompanying portrait of Mr. John McLennan, of the General Post Office, Edinburgh, the popular president of the club; and also a photograph of the handsome challenge cup, which this gentleman has been instrumental in presenting to the members. The cup was subscribed for by members of the post office staff and other friends of the club, and has been named the "McLennan" Challenge Cup. It will be sailed for in due course on the Inverleith Pond. Mr. McLennan has taken great interest in the welfare of the Edinburgh and Leith M.Y.C., and has frequently been of much assistance in securing specially favourable consideration from the railway companies when the members have been making one of their numerous excursions.

This club ran a well-contested race on May 13th, with a start of twelve boats, made up as follows:—Five of Class III., six of Class II., one of Class I.; time allowance two minutes for each class, the result being Mr. John Marshall's *Whiteheather*, Class II., first; Mr. R. S. Porteous's *Alice*, Class III., second; Mr. R. Bruce's *Corina*, third. A race for Mr. G. Hamilton's special



THE "McLENNAN" CHALLENGE CUP.

prize on May 23rd, on Inverleith Pond. There were eleven entries, the starter being Mr. George Hamilton, and the flagman a stranger. Resulted as follows:—Mr.

Millar's *Thistle*, first; Mr. Porteous's *Alice*, second; Mr. Marshall's *Whiteheather*, third. On Saturday, May 27th, there was a race for Mr. David Harper's special



MR. JOHN McLENNAN

(President of the Edinburgh and Leith M.Y.C.).

prize. The starter was Mr. George Hamilton, and the flagman Mr. Harper. There were nine entries, the result being Mr. Bruce's *Corina*, first; Mr. F. Kerr's *Empress*, second; Mr. J. Marshall's *Whiteheather*, third.

Highgate M. Y. C.—This club holds its meetings every Saturday afternoon at the large pond at Highgate, wind and weather permitting. The first challenge prize race was held on April 15th, when four boats started in a fair north-westerly breeze. Mr. G. Ward was the officer of the day; the course was three boards to windward and three off the wind, the result being that *Briton* (Mr. Field) made 13 points; *Edie* (Mr. Bickerton), 11 points; *Ethelwynn* (Mr. Vine), 9 points, and *Asphodel* (Mr. Findon), 3 points. On April 29th the first race for the silver challenge cup took place in a good south-westerly breeze. Five boats entered, the result being that *Mildred* (Mr. Vine) made 13 points, *Briton* (Mr. Field) being second with 10 points, and Mr. Kent's new 10-rater third with 7 points. On May 13th the second challenge race took place in a steady south-west wind, which gave excellent sport, the match ending in *Briton* being first with 11 points; *Edie* (Mr. Bickerton), and *Ethelwynn* (Mr. Vine) were tied with 8 points each; *Victoria* (Mr. Stubberfield), 7 points; *Asphodel* (Mr. Findon), 2 points. On May 27th nine 10-raters started in the second match for the silver cup, three being new boats. The score-sheet at the finish showed that *Mildred* (Mr. Vine) was first with 11 points, *Briton* (Mr. Field) second with 9 points, and *Vera* (Mr. Gerard) third with 6 points. The sailing all round was very good, and, it being a fine day, a large number of spectators were present.

List of Model Yacht Clubs.

WE append below a list of model yacht clubs in various parts of the United Kingdom, with the names and addresses of their secretaries or other responsible officers. As a list of this kind should be very useful to clubs wishing to arrange matches with one another, we desire to make it as complete and reliable as possible, and shall therefore be glad to be notified of any corrections necessary, or of any clubs which may have been omitted:

- LEITH.—Wm. Cunningham, 1 Cannon Street, Leith.
 TYNEMOUTH.—H. Sharp, 13, Penman Street, N. Shields.
 MANCHESTER.—Hugh Avery, 20, High Street, Manchester.
 S. SHIELDS.—R. S. Terviel, 98, Broughton Road, S. Shields.
 PORT OF BRIGHAM.—S. Wheaton, 4, Sunbury Terrace, Furzham, Brigham.
 EDINBURGH AND LEITH.—A. Flockhart, 25, Eyre Place, Edinburgh.
 PAISLEY.—James Gemmell, 6, Laighpark, Paisley.
 VICTORIA.—James M'Intyre, 1158, Dumbarton Road, Whiteinch, N.B.
 SERPENTINE.—A. Lewis, Esq., 109, Castle Street, Battersea, S.W.
 EAST HULL.—J. E. Walsh, Esq., 64½, Thomas Street, Holderness Road, Hull.
 SWANSEA.—S. B. Cozens, 9, Brunswick Street, Swansea.
 GUERNSEY.—Ira C. Ozanne, 5, Court Row, Guernsey.
 TENBY.—F. G. Hughes, Harbour Master's Office, Tenby.
 PORT OF PLYMOUTH.—G. F. Watson, 14, Smeaton Terrace, West Hoe, Plymouth.
 H.M.S. "CURAÇOA."—J. Wells.
 SOUTHAMPTON.—J. Houghton, Esq., Stanley House, Marine Parade, Southampton.
 LOWESTOFT.—J. F. Tansley, Esq., Beach Road, Lowestoft.
 ROATH PARK.—W. Eastabrook, Esq., 39, Oakfield Street, Cardiff.
 VICTORIA (JERSEY).—Mowatt Godfray, Esq., 35, Esplanade, Jersey.
 DUNDEE.—Geo. Ritchie, Esq., Mercantile Marine Office, Dundee.
 HIGHGATE.—W. T. Vine, 15, South Hill Park Gardens, N.W.
 BARROW-IN-FURNESS.—Walter Wilson, 6, Brown Street, Barrow-in-Furness.
 WIRRAL.—E. W. Wynne, 35A, South John Street, Liverpool.

Racing Reports.

[Secretaries are invited to furnish the Editor with regular reports of their Club races, for free insertion under this heading. The value of these reports to other readers will be greatly increased if some detailed particulars as to design and measurements of the winning boats are given.]

Paisley M.Y.C.—The following races have been held this season:—April 8th, eight yachts entering; April 15th, twelve entries; May 6th, juvenile handicap race, three entries; May 13th, race for Dr. Holms' medal, fifteen entries. In the result the *Cora* was first, winning the gold medal; *Foris*, second; and *Lady Agnes* third. The race was keenly contested in a nice breeze, and drew the biggest entry of models the club has had.

Plymouth M.Y.C.—This club held their opening cruise, and first of a series of four races to select the three best "20-rater" models for the West of England Challenge race, on Saturday, April 15th, 1899. The course comprised a beat to windward from a yacht off Jennycliff around the Asia Buoy, leaving it on the starboard hand, and a reach finishing between two yachts off the Promenade Pier. Mr. J. Grey officiated as sailing officer. Six models were at the starting-point: Mr. Sander's *Britannia*, Mr. Vicker's *Why Not*, Mr. Hodge's *Althea*, Mr. Houlditch's *Porpoise*, Mr. Pool's *Fern*, and Mr. Ferguson's *Trixie*. The signal to go was given at 3.30 p.m., all yachts being on the port tack. The order at the finish was *Althea*, *Why Not*, *Porpoise*, *Fern*, *Trixie*, *Britannia*. The second race of 20-raters was sailed on Saturday, April 22nd, off the Hoe. The course comprised a beat to windward from the Promenade Pier around Malampus Buoy, leaving it on the starboard hand, and a reach, finishing between Drake's Island and a brig buoy. Mr. J. Grey was sailing officer. Seven models were at the starting line: Mr. Pool's *Fern*, Mr. Sander's *Britannia*, Mr. Ferguson's *Trixie*, Mr. Vickers' *Why Not*, Mr. Gough's *Tom Cat*, Mr. Houlditch's *Porpoise*, and Mr. Hodge's *Althea*. The signal to let go was given at 3 p.m., all yachts being on port tack. The order at the finish was *Tom Cat*, *Why Not*, *Britannia*, *Porpoise*, *Althea*, and *Trixie*. On Saturday, May 6th, the third race of 20-raters was held off the Hoe, Mr. J. Grey acting as sailing officer. Six models were at the starting line. The order at the finish was *Why Not*, *Tom Cat*, *Britannia*, *Althea*, and *Trixie*. *Porpoise* was not timed.

Tyneside Championship Cup Race.—The fourth race for this cup, subscribed to by the Newcastle, Jarrow, and Tynemouth Model Yacht Clubs, was sailed on Hexham reservoir on Whit Tuesday. Each club was represented by six 15-rating models, each yacht sailing all the yachts of the opposing clubs. The cup had been won by Tynemouth (first year), and by Newcastle twice since, and only required to be won by the Newcastle Club this year to become their own. The race was commenced at 11 a.m., with sky overcast, and before many heats were sailed the rain commenced. A spell of fine weather after this enabled the race to be got well on with until the rain, coming on again, stopped racing, and the remaining heats were unsailed. The score then stood: Newcastle, total 37; Tynemouth, total 33; Jarrow, total 28. The Newcastle yachts, still with nine heats to sail, were then proclaimed the winners, as Tynemouth only had one heat to sail, and Jarrow, though they had ten to sail, deemed it impossible to beat the city men. As six of the yachts had equal chances for the prizes for the yacht with the best score, they divided the prizes. These were the first four Newcastle yachts, *Rover* (Tynemouth) and *Aminia* (Jarrow). The racing was very close and stubbornly contested. Mr. Geo. Waite, Newcastle, officiated as judge, while the sailing arrangements were made by Mr. Hy. Sharp, hon. sec. Tynemouth Club. As the Newcastle Club have won the cup three times in succession, they now become the absolute possessors of it, and as they won the 10-ton Tyneside inter-club cup on Easter Tuesday, they hold the blue riband of model yachting in the Tyneside district.

Cardiff M.Y.C.—The Cardiff Model Yacht Club brought off on Saturday, May 20th, the first of a series of races to take place on the third Saturday in each month, these races to be sailed under a tonnage measurement, as a test against their present load-water-line rule, the same handicap of thirty seconds per ton being given. A strong westerly wind prevailing made a good reaching race up and down the lake, which had to be covered three times,

equal to two miles. In the third round *Aerial* and *White Rose* retired from the race, leaving *Ivor*, *Mildred*, *Scillonian*, and *Madge* to finish one of the closest races sailed by this club. Mr. Eastabrook officiated as starter and referee. On Saturday, May 27th, the club sailed its first race this season for the silver cup given by Mr. T. A. Reed, N.A., in the Jubilee year, the cup to become the property of the one who wins it with the same boat three times not necessarily in succession. During the year 1898 four races were sailed for the cup. *Dodger* became the cup holder. Mr. David Thomas took this race in hand as referee and starter. On Saturday, June 3rd, the club had a match for a cup given by Mr. F. Martin, the course being the usual one—three times up and down the Roath Park Lake, equal to two miles straight. The wind being light, the race was completed three minutes under the stipulated time, 1 h. 15 min. The following boats were started at 4.18 :—*W. Baker*, 40 ins.; *Ivor*, 41 ins.; *Dodger*, 42 ins.; *White Rose*, *Carrie*, and *Madge*, 44 ins. *Dodger* won the cup, with *Ivor* second, *White Rose* third, and *Mildred* fourth. It was a good finish, feet only separating them. Mr. Hussey acted as referee and starter, and Mr. D. Thomas assisted at the top line.

South Shields M.Y.C.—The annual competition for the H. S. Edwards Cup took place on Whit-Monday morning, and, as usual, was keenly contested. After a most exciting contest, Mr. McPherson's *Freedom* won premier honours, Mr. Thomas Young's *Victoria* coming in for second prize. Mr. A. Thomas acted as judge and Mr. C. Bennett as starter, and everything went off without a hitch. The wind was from the south east, blowing a fresh breeze, and made racing very pleasant. The cup was presented to the South Shields M.Y.C. by the late Mr. H. S. Edwards, of Corbridge, four years ago, and has been won the first two seasons by this year's winner, Mr. McPherson, and was won last year by Mr. R. Ter-viel.

[NOTE.—We regret that owing to unusual pressure on our space we have been obliged to hold over several racing reports.—ED. M.E.]

The A.B.C. of Dynamo Design.

By ALFRED H. AVERY, A. Inst. E.E.

(Continued from page 85.)

CHAPTER III.

IT was pointed out in the concluding portion of the last chapter that, although the various windings of armatures may differ much in method and appearance, yet their connections are invariably such as to give the same circulation of current. Such "circumflux" will be represented by the sectional arrows in Fig. 18.

Now, we know that current cannot flow round an iron core without producing magnetic effects in it, and a very elementary acquaintance with electro-magnetic laws shows us that when this armature current begins to circulate, poles n s (Fig. 18) will be developed in the armature core at right angles to those N S of the field-magnet; and the greater the circumflux (or current flowing round the armature) the stronger will this armature polarization become.

In the dynamo at work there are thus two magnetic effects, both going on at once :—The flux due to the field magnet, the *useful* field and origin of the E.M.F. (Fig. 19) and that due to the armature magnetisation, the *wasteful* and *parasitic* field (Fig. 18).

As a result of the combination of these two effects, the natural field will be somewhat distorted in the direction of rotation of the armature (Fig. 20).

This leads to another complication; the brushes, instead of being placed vertically and equidistant from each pole piece (as would be the case were there no distortion), must, if we are to collect the E.M.F. when it arrives at its highest value, follow round with the displacement

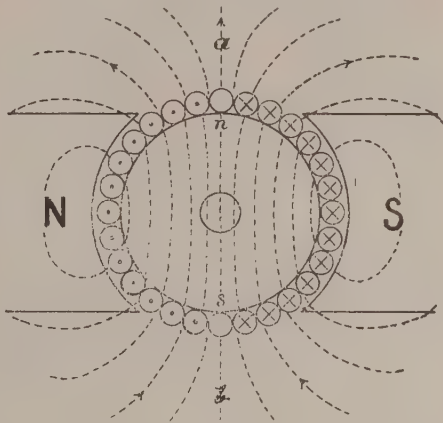


FIG. 18.

of the field, *i.e.*, they must be given a "forward lead"; which again tends to make the armature poles become more oblique, to a further degree increasing the cross-magnetising field.

The total E.M.F. generated in any armature is the sum of the separate E.M.F.'s induced in these coils in series with one another between brush and brush. Thus, although from their individual positions in the magnetic

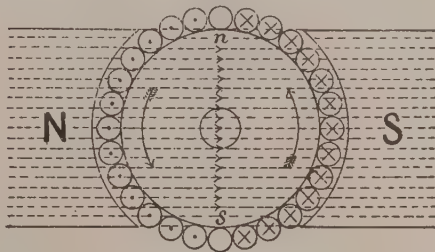


FIG. 19.

field the conductors cannot all contribute an equal amount of potential, the effect is cumulative; the induction in one coil adding itself to that in the next, and so on. It follows, therefore, that to get the greatest amount of E.M.F. the brushes must be placed on a "neutral" line, corresponding to the axis of the distorted magnetic field (a b , Fig. 20), on either side of which E.M.F. of different sign will be generated.

When from distortion of the field it is found necessary to give "lead" to the brushes in order that they shall follow this neutral line (n s , Fig. 21) in its displacement, there comes into operation a *de-magnetising* action—quite

distinct from the *cross-magnetising* effects just dealt with, and belonging to that vertical belt of conductors formed by shifting the brushes out of their symmetrical position with regard to the pole pieces. This is indicated in the shaded portion of Fig. 21. By studying the direction of current in the armature as here illustrated, it is plain that

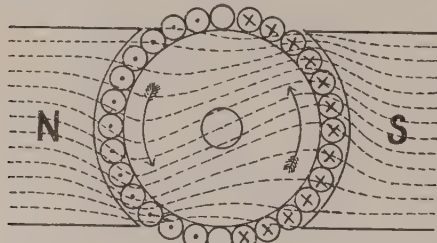


FIG. 20.

the belt of conductors included in the angle of lead must tend to produce in the armature poles $n^1 s^1$, which are directly opposed to those of the field-magnets N S, and the tendency will be to again weaken the useful field.

To the casual reader all these details may seem of little interest, besides being difficult of comprehension; but let it be remembered that a proper knowledge of armature

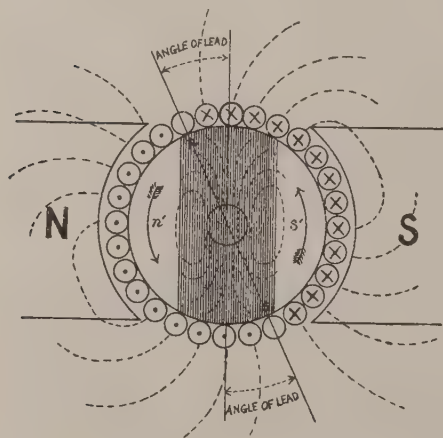


FIG. 21.

action and reaction is most essential to the dynamo-designer, since the application of the proper remedies for these various evils makes all the difference in the world between a well-designed and efficient machine or the reverse.

There are two other sources of loss—eddy currents and hysteresis; both dependent on the presence of *iron* in the armature core, as distinguished from the action of the *copper* conductors. The former of these depends upon the distribution of the iron, and the latter upon its magnetic qualities. If the iron core were solid, it might be likened to a short conductor of great sectional area, and therefore of little resistance; and would be subject to the usual laws of induction when rotating in a magnetic field. Consequently, enormous currents at a very low potential, termed "eddy" currents, sometimes

Foucault currents (after the name of their discoverer), would circulate in it, as in Fig. 22 (which shows the half armature only) and soon cause great heat. This explains why small armatures, which are sometimes cast solid, invariably get hot after a short run. Fortunately the remedy for this is easily applied; it is only necessary to "lamine" the armature in a direction at right angles to flow of the eddy currents. In practice, this condition is fulfilled by building up the cores of thin plates or laminations—often termed "core discs," pressed together

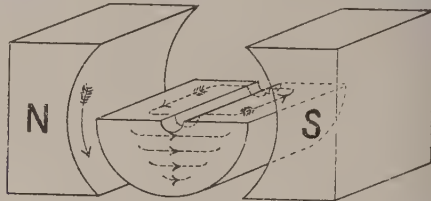


FIG. 22.

so as to form practically a solid armature, offering little resistance to the magnetic flux, but presenting a great obstacle to the flow of eddy currents; the film of oxide on the surface of the laminations is a poor conductor and quite sufficient in short armatures to insulate each core disc from the next. In long armatures, where the potential of the eddy currents has naturally a higher value, it may be necessary to varnish one side of each core disc, or insert thin paper between them as an additional precaution; but as a general thing this is a needless refinement.

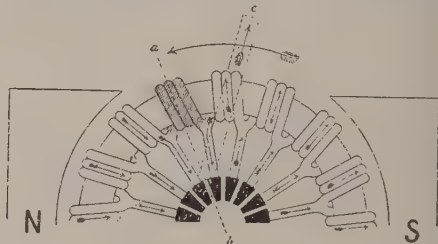


FIG. 23.

Hysteresis, or magnetic friction, is a tendency of the magnetism in the iron to lag behind the magnetising force. The poles in an armature core are continually circulating, each part of the iron passing through successive cycles of N to S and back again, at a very high rate of speed. This pole reversal, however, being comparatively gradual, the tendency to lagging is not very great, and by employing only a thoroughly good brand of iron for the armature core, hysteric losses may be counted negligible.

Before leaving the subject of armature reaction, a word or two must be said respecting *commutation* of currents, which, if not properly adjusted, shows itself by sparking at the brushes and loss of potential. We have seen that the act of commutation should, theoretically, be timed to take place when the current in the conductor reverses; but, as every student will be aware, it is impossible to start or stop instantaneously the flow of current in any circuit possessing "self-induction." Now, the self-induction of a single turn of wire in air is inappreciable, but in the case of many turns surrounding an iron core—such as Fig. 23, for instance—may be very great indeed, and it will be as impossible to start, stop, or reverse instantaneously the current in that coil as it would be to try and

stop, start, or reverse the motion of a heavy flywheel. This is why, with the old form of Siemens H armature, sparking is so pronounced and destructive. Observe how great the fluctuation is in the typical E.M.F. curve of this armature (Fig. 12). But take the case of a ring armature where there are many sections, and the typical E.M.F. curve approximates that given in Fig. 14. What will be the conditions necessary to secure sparkless running? There is certain to be some self-induction, however small, in each of the armature coils, and as each one passes the neutral line or diameter of commutation (*a b*, Fig. 23), it is equally certain there will be trouble when the current tries to flow two ways at once in that particular coil! To meet this little difference of opinion, therefore, the brush *c* is made of sufficient thickness to bridge two adjacent commutator segments over the insulation, practically short-circuiting the shaded coil, and thus giving the current in the commutated coil time to die away gradually before taking up one in the reverse direction: and not only just sufficient time to stop, but it is allowed to travel just far enough into the opposite field to acquire some little E.M.F. of contrary sign, in order that there should be no difficulty in starting the reverse current in that coil again. This is done by making the brush of sufficient angular width and moving it into such a position that the commutator segment to which that coil is attached just leaves the brush when this cycle of operations has been performed.

(To be continued.)

The Editor's Page.

DURING the past few months we have received several letters from younger readers of the paper asking that we would devote a little space regularly each month to dealing with elementary mechanical and electrical matters. The correspondents who have written us on this subject find that the majority of models and appliances described in these pages are rather beyond their skill, and they suggest that some articles on the subject of workshop tools, and the proper way to use them, would be very acceptable and would help them in making more successful attempts at carrying out the designs for engines and apparatus which we publish. We are quite willing to do what we can to fill this want, and, commencing with our next issue, will try the experiment of a page for young engineers and electricians. In the meantime, we should be glad to hear further as to the exact subjects on which instruction is needed.

We still continue to receive evidences of the widespread circulation which THE MODEL ENGINEER has now attained, our last two letters from abroad coming from readers in the Straits Settlements and the Soudan respectively. In the latter case the writer, who holds a responsible position on the military railways which are now being constructed, dates his letter from Wady Halfa, and says:—"I am a great admirer of your little paper, and I look forward to it more than to any other I receive out here."

While on the subject of our correspondence, we may mention that one letter, received during the past few days, brought quite a vivid blush to the modest editorial

countenance. It came from a reader in Liverpool, and was thus addressed:

The Editor of

The Most Sensible Paper in England,
"The Model Engineer,"

6, Farringdon Avenue,
London, E.C.

Our office boy, as he handed the letter to us, held his head several inches higher than usual, and we have a strong suspicion that he intends to ask for an early rise in wages. It was a fortunate thing that the sender put "THE MODEL ENGINEER" on the envelope, as there are several other journals issued by our publishers, and if their respective editors had caught sight of the commencing portion of the address, the scramble for that letter would have been a sight worth seeing!

The champion model-maker has been found at last, and an illustrated account of his work appears in No. 1 of the new *Penny Pictorial Magazine* in an article entitled "A Fleetlet in Being." We call him the champion model-maker because for the last twenty years he has, with his own hands, been turning out accurate scale working models of battleships, cruisers, destroyers, and torpedo boats, some of which must be 8 or 10 ft. long to judge by the illustrations, at the rate of nearly five vessels per annum, a feat which no other model maker of our acquaintance would dream of attempting, and we believe we know most of the men who are considered smart at this class of work. Curiously enough this mechanical genius is a wealthy private gentleman who makes the work a hobby, and is so fearful of being worried by applications from the public to view his model fleet that he binds the writer of the article down to absolute secrecy as to his place of residence. We can fully appreciate the writer's anxiety to impress this fact upon his readers, as also his reticence to disclose the "wonderful story" and the "marvellous discovery" referred to at the conclusion of the article. We need not say much more to make clear our belief that the whole thing is neither more nor less than a journalistic "fake." Ingenious it may be, but we very much question the taste displayed in endeavouring to foist upon the public as fact what can only be a piece of purely imaginative writing.

The last date for sending in for our competition No. 7 is June 30th. Will those readers who have not yet forwarded their attempts kindly bear this in mind?

The suggestion for an afternoon meeting of readers who possess model steam or electric boats, which we put forward in our last issue, has not brought us any replies from the general readers of the paper, but the Society of Model Engineers are taking the matter in hand, and several of the members have promised to show their boats at work. There must be many other amateurs in the London district who could produce model craft worthy of notice, and we hope they will dispense with a little of their present excess of modesty, and consent to bring up their boats for a trial trip.

How to Make a Hand-Planing Machine.

By FRANCIS W. SHAW.

WHEN the amateur has gratified his ambition by either making or buying a lathe, and is thereby enabled to turn his shafts, screws, pins, piston-rods, and to bore his cylinders, flywheels, &c., he begins to find out that the production of the many plane surfaces necessary in his constructions involves a lot of painstaking effort when it has to be done by means of chipping, filing, and scraping from the rough. Consequently, he looks out for some method whereby the hard hand and head work may be converted into plain, straightforward, and—it may almost be said—automatic machine work. He already has the lathe, and an attachment for doing this particular portion of his work by milling or shaping usually strikes his mind as being the easiest way out of the difficulty. The ideal of many amateurs seems to be to make the lathe as universal a tool as possible. This is an excellent aim in its way, looking at it from the standpoint of pride, and the lathe is no doubt capable of being used far beyond its original intended purpose; but when the working out of this ideal results in a great waste of energy in overcoming a lot of unnecessary friction by his own exertions, and the loss of time occasioned by fixing up and removing his tackle, the amateur often thinks twice before he will take the trouble thus involved, and often reverts to the old method of doing the work by hand.

For surfacing areas of any size, I do not consider lathe milling and shaping attachments are capable of doing the work conveniently, if even well, for there is too much vibration, and when it is considered that a small planer, self-contained in every respect, can be built as cheaply, or even at less cost, than can first-class attachments, and is, at the finish, always ready to hand, it may be said, "The game is not worth the candle."

Having these facts well in mind, and also the general requirements of the amateur's class of work, I have devoted a great amount of time to designing and getting out patterns of a small machine which will bear out the conditions, &c., which I set before myself previous to commencing—viz., it must do all the planing necessary in the construction of model engines, locomotives, dynamos, motors, cutting keyways, internal and external, small slides, angular or parallel portions of small lathes; must be capable of taking a cut sufficiently large to get under the skin of castings, and of cutting any material softer than the tool itself, without vibration, and to be geared up so that there be no great strain on the muscular powers. It must also be strong enough to withstand accidental blows, and to do any work that can possibly be done by hand without springing (an idea of the strength of the machine under description may be gathered from the fact that it is arranged to take 9-16ths in. square tools), and yet be light. To secure this latter advantage I have taken particular care to so distribute the metal as to make the portions which are under strain, as strong as possible. Lastly, its bearing surfaces must be large, and well proportioned, and all wearing parts adjustable to take up wear; the rough material must be capable of being fitted up well and easily; all attachments for securing work to be simply and easily fixed, with no long threads to adjust, and the machine, when finished, must have a neat, artistic appearance, in view of the fact that the amateur likes to take a pride in his workshop and appliances.

I do not purpose to describe how to make the patterns, as the castings may be obtained very cheaply; but if any-

one desires to make the machine throughout, I shall be happy to afford him all the information that lies in my power. It will be necessary for those who have no planing machine to get them ready planed, or have them planed up by some friend, unless he cares to undertake to get them up by hand and "hard graft"; the castings may be got up this way as only a small amount is allowed for planing, only just sufficient to clean them up. The machine will take articles up to 16 ins. in length, 7 ins. wide, and 5 ins. deep.

I think it better, before proceeding to a detailed description of the several parts, to place the machine in its entirety—ready for use—as shown in the accompanying engraving from a photo—before my readers, in order that this first article may be as complete as possible, and that the experienced may sail right away, without wading through a lot of—to them—uninteresting matter.

It will be noticed that the style of driving chosen is by rack and pinion, actuated by a hand lever, adjustable in its socket to obtain the requisite power for different degrees of cut or qualities of metal.

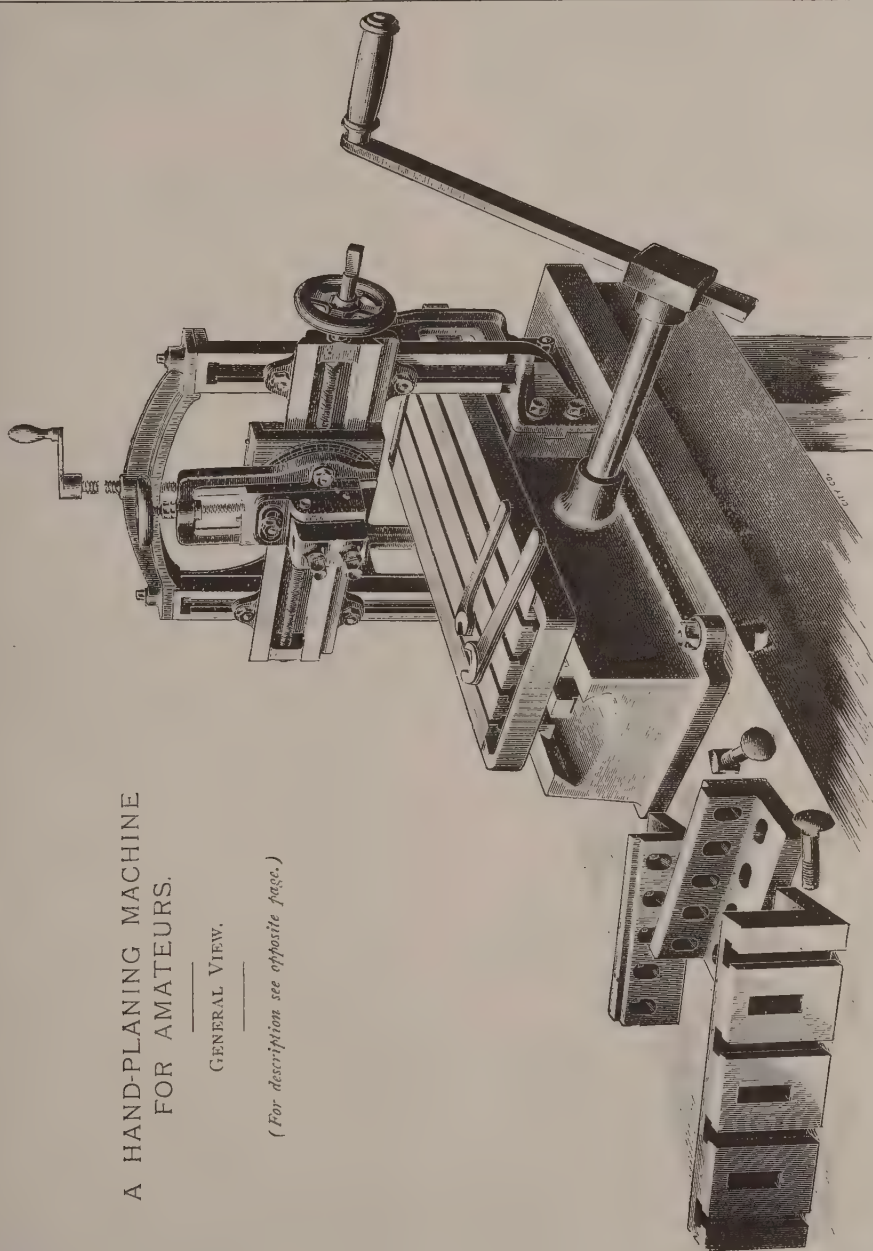
I make no apology for diverging so much from the ordinary pattern of handle—the capstan handle with four levers, or the single *straight* lever one—as by long experience in using a similar machine, with all three styles, I have been driven to the use of the one shown. By those who have used the capstan, it will, no doubt, have been noticed that the three levers not in use are constantly in the way and liable, at any time, to give one a nasty knock; and not only so, but the peculiar strain on the wrist entailed by using a radial lever is very painful, and does not allow one's full power to be exerted. It is true that the disadvantage is not felt while taking a short stroke, yet, when the length of cut necessitates a whole turn or more of the shaft, the disadvantage will be seen and felt to a painful degree.

The rack is secured to the table by three 5-16th in. nicked screws, let in from the top of the table in the centre slot (there are only three slots in this machine, although four are shown in the illustration), and the strain is taken by two 1/4 in. pins let through the table into the back of the rack. The pinion is secured on to the driving shaft, which is 1 1/4 in. bright steel rod, by a taper pin passing through the boss, which will be found on one side of the pinion, and also through the shaft. The pinion also acts as a collar by which the shaft is kept in its position. An adjusting strip is provided to take up wear, and is fitted in the usual manner.

The uprights are tenoned into the sides of the bed, this method doing away with the strain which falls on the bolts when the uprights are fitted to the top of angle brackets cast on the sides of the bed, and each is secured by four hexagon headed set screws, 3/8 in. diameter. The slots which carry the bolts to bind the cross slide to the uprights are $\perp$ shaped, and the outside of the slots are V-d to fit corresponding vees on the back of the cross slide, this ensuring that the cross slide will, when fitted up, maintain its original parallel position with respect to the machine table, and doing away with the constant need of adjustment—an adjustment usually effected by taking a cut over the table—usually required when it is held by two screws.

The uprights are stiffened sidewise by the top cross-bar, which also serves the purpose of a nut for raising the cross slide, being tapped out to receive the square thread screw, which is 5/8 in. in diameter, 6 pitch.

The cross slide saddle—so-called by reason of its shape—is fitted in the usual way, having an adjusting strip similar to the one underneath the table. The leading screw is 9/16ths in. (or 1/2 in.) diameter; six or eight threads per inch left hand. The left end is fitted with lock nuts to keep the screw in position, and the right end



A HAND-PLANING MACHINE
FOR AMATEURS.

GENERAL VIEW.

(For description see opposite page.)

squared for a handle. A gunmetal nut is fitted to the back of the square and tapped out to receive the screw. A turned and polished handwheel is also keyed on the handle end to facilitate gradual feeding.

I might say here that an even feed is important to ensure the production of good true work, and this regular feed is only to be attained by practice. A self-feeding arrangement might be added, but this I do not recommend, it being a source of annoyance rather than otherwise, and as ordinary work may be done by one hand, the other hand may be employed usefully this way; and, anyway, serves to relieve the monotony, and even when both hands are required to take a heavy cut the feed can be taken during the return stroke.

The fiddle (notice the shape) or vertical slide is arranged to swivel on the square in order to take angular cuts—work in the nature of the slides of a slide rest. The lifting screw is 7-16ths in. square thread, 8 pitch left hand. The fiddle is secured to the square by two 7-16ths in. T-headed bolts fitting into a groove undercut in the square. It will take a 6-in. lathe to turn the fiddle, and amateurs who have not a lathe this size will require this turning for them. The nut is fitted into the piece which slides on the fiddle in an improved way, seen readily by the shape of the castings. The tool box base is fitted in such a manner as to allow it to swivel for giving a clearance to the tool in taking vertical cuts.

The tool box itself is pivoted on a taper pin, adjustable laterally to take up wear, and secured by lock nuts. Two square-head set screws are provided to secure the tools.

All screws and nuts which are subjected to compression by spanners, should be case hardened, and oil holes should be drilled into all the bearings, and a small nicked screw fitted therein to exclude dirt.

The next paper will describe in detail, and working drawings will be provided for the instruction of those who cannot follow, owing to insufficiency of knowledge, the foregoing, and as a concluding paper, readily adaptable methods of converting the machine into a handy milling machine, capable of doing a vast amount of work, will have consideration.

(To be continued.)

[NOTE.—Castings for making the machine described in this article can be obtained from Messrs. F. & H. Shaw, Ltd., Hebden Bridge.]

Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.]

How to Colour Electric Lamps.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Occasionally amateur electricians wish to know how to colour electric incandescent lamp globes, and I herewith take the opportunity of describing a method: Dissolve 1 oz. of orange shellac in 10 oz. of methylated spirits, and filter. To this add enough of an alcoholic solution of dye (made by dissolving a penny packet of Judson's dye, choosing colour of dye) in 1 oz. of alcohol to give sufficient depth of colour. Warm glass globe gently and warm the varnish by placing in a vessel of hot water and dip globe in, repeating the operation, if necessary, after each coat dries.—Yours truly,

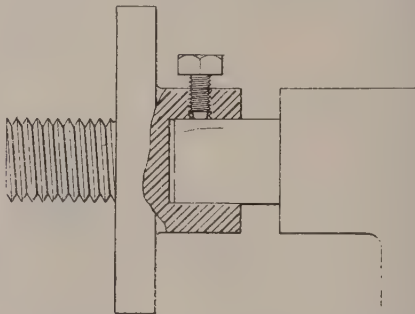
Ellyer Holm, Dalmuir.

F. M. C.

Chucks for Loose Headstocks.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—An alternative plan for holding face-plate, chucks, &c., on loose head barrel, which I have used for years in my own shop, is as shown in accompanying sketch. We use our mounting chiefly for hold-



ing shell reamers when finishing bored holes. The nose may be made same as mandrel nose; this will allow of face plates and drill chucks being used. The taper plug arrangement, which "S. C." advocates, is all right if the taper be long and well fitted, but the success lies in the fitting.—Yours sincerely,
A. P. H.,
Sheffield.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Replying to "S.C.'s" reply, I must say that a duplicate nose on the barrel of the tailstock is not uncommon. Birch & Co., of Salford, sometimes make them thus, and Britannia Company have made them so. No matter how small in diameter the barrel may be, it is possible to have a collar forged on to form a thrust for the boss of the face plates or chucks. As to being liable to damage any more than other important parts of the lathe, I cannot see. In saying that the plate was liable to turn round in the taper hole, I was referring particularly to the use of drills rather larger in diameter than the size of the hole, and I spoke from experience, for at one time the self-same idea necessitated a barrel being re-bored, and new centres being made. Drill chucks may be fitted this way, but then the capacity of the chuck is usually small, compared with the size of the taper shank.

Hebden Bridge.

F. W. SHAW.

Brass Foundry Work.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I see by your June number that you have been wrestling with one of your correspondents on the difficulty in making proper brass castings after the manner of my instructions in your May and June numbers of last year.

If you will allow me to help in the matter, I should like to do so by offering the following suggestions.

In the first place, Mr. Editor, I think you were quite right in replying to your correspondent "that you would like first" to see his mould "before you could tell the reason of his failure."

The chances are—as with all beginners—one of the boxes has had its sand rammed much harder than the other, and it follows, as almost a certainty, that the box (whether top or bottom one) that has been rammed quite hard is sure to retain, or draw back on parting, a portion of the sand in the box that has only been softly rammed. When an amateur commences the ramming process, and has finished one of the boxes satisfactorily, he invariably

at first, on ramming the sand in the upper box, imagines that he must not put the same force on as he did in the lower box, from fear of disturbing not only the "parting," but also the contents in the lower box. This, of course, is only imaginary, and dies away with practice. Both boxes should be treated exactly the same—equal ramming throughout. The "parting" will never be disturbed.

2. As to this "parting" business, I would suggest, as the quickest and easiest plan, to your correspondent, that he should call at the first iron or brass foundry that he knows of, and, when he arrives there, walk boldly in and look around for a good-natured looking man. Having found such a man, offer him a "tip" for a handful or two of drying sand, explaining briefly what he requires it for. I will guarantee that your correspondent will return home rejoicing, with as much of this precious "parting" sand as will last him for many months. He might at the same time inquire, of course, where it is to be obtained, for naturally some kinds are much superior to others; but I am quite certain of one fact concerning it, and that is, if the best quality is obtained, and it is perfectly dry, there is really no necessity for baking it at all.

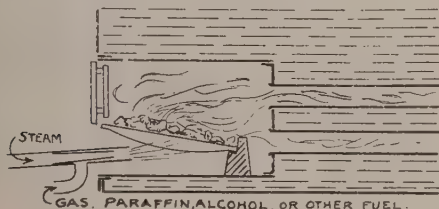
Trusting that, after your suggestions and these few points that I have dwelt on, your correspondent will have better success in the future,—Yours truly,

Weymouth. LIONEL VARICAS, C.E., B.Sc.

Two Novel Suggestions.

TO THE EDITOR OF *The Model Engineer*.

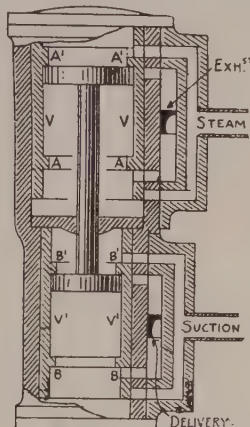
SIR,—I have thought that asbestos, in small lumps, such as is used in a brazing-furnace with a blowpipe, might be employed for firing model boilers in the following way:—The asbestos to be put on the firebars, just as is done with coal or charcoal, and kept at a bright red heat by means of a steam blowpipe; that is, one using steam instead of air. I have tried this blowpipe in a forge at home, and soon acquired a temperature sufficient to melt brass spelter (using coke, not asbestos), so that if the bars were at an angle, and the blowpipe underneath, as shown in accompanying sketch, the difficulty of charcoal would be overcome, and *this fire would not want stoking*.



Will you please tell me what you think of this arrangement, and how paraffin, petroleum, methylated spirits, or any other liquid which you consider most suitable, could be vaporised to supply gas for this blowpipe?

I also enclose a diagram of a steam feed pump, which I have designed with the object of compactness. I think that the diagram will explain itself, but perhaps I had better add a few words. The piston is shown at the top of its stroke just starting downwards. When it reaches the bottom, it engages with the rim A, and thus moves the valve V downwards, which, as will be seen from diagram, opens the steam port into lower end of cylinder, and exhaust from upper end. The piston then returns, and engages with the upper rim A' and moves the valve V up to the top again. The motion then re-commences.

The valves in the pump at the bottom work in the same way, but, of course, ordinary ball valves would do for this. I shall be glad to have your opinion of the above suggestion, and also those of your readers. If needed, I



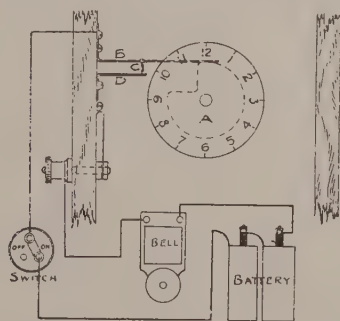
shall be pleased to give any further particulars required. Feed-pumps worked off the propeller shaft by an eccentric or worm wheel use a great deal of power out of the engine, I believe. That is why I have endeavoured to design an independent one.—Yours truly,

West Norwood. V. B. H.-M.

Electric Clock Alarms.

TO THE EDITOR OF *The Model Engineer*.

SIR,—The clock I used was an ordinary kitchen alarm clock. In the centre is a brass disc with the hours I. to XII. marked on. At the back of this there is a brass quadrant (A), shown by the dotted lines, which revolves round with the hour hand. To the side of the clock I screwed a piece of springy copper (B), just long enough



to overlap the quadrant (A); to this I rivetted loosely a piece of thin copper wire (C); below this I fastened a piece of stiffer copper (D). The diagram shows the clock just about to make a connection between C and D. It will ring for about an hour if not stopped. I have had the clock in use about four months, and up to the present I have had no trouble whatever with it.—Yours truly,

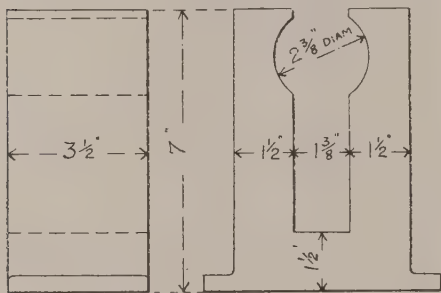
Brighouse, Yorks.

E. C.

Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.]
The following are selected from the queries which have been replied to recently:—

[183] **Overtype Dynamo.** C. B. J. (Bucks.) writes: I enclose sketch of an overtype dynamo which I am building. Would you be so kind as to tell me what size wire for winding it, and at what speed it should be run to give 20 volts and 8 amps? It has a Siemens laminated armature. Will this charge accumulators? If not, could



I fit it with a three pole pattern armature, $2\frac{1}{4}$ in. diam? Any information will be thankfully received.

It is doubtful whether you can get an output of 8 amps. at 20 volts from this machine. An ordinary Siemens armature is not suited for charging accumulators. If you can get tripolar stampings, $2\frac{1}{2}$ in. diam., they would be suitable, but a machine of this size would probably do much better with a drum type armature. Supposing you use the tripolar stampings, after well taping all parts touched by wire, wind the armature with as much No. 16 S.C.C. wire, very carefully and closely, in three equal quantities. Get on if possible $1\frac{1}{2}$ lb. of this wire. The field-magnets must then be wound with about 8 lb. No. 18 D.C.C. wire, and connected in shunt. At about 2,200 to 2,500 revolutions, you may get from 6 to 8 amps. at 20 volts.

[193] **20-c.p. Manchester Dynamo.** D. M. (Hamilton, N.B.) writes: Would you kindly give me particulars of the size of field-magnets and core; also, amount and size of wire required for a 20-c.p. Manchester model dynamo, with drum armature? The field-magnets and core are to be made of soft wrought iron.

Let the drum armature be 2 in. diam., 4 in. long, wound with 12 ozs. No. 22 S.C.C. wire in twelve sections (about $7\frac{1}{2}$ yards to each section). The armature tunnel will need to be about $2\frac{1}{2}$ in. diam.; top and bottom yokes, 4 in. wide, $\frac{3}{8}$ in. thick, 6 in. long; F.M. cores, 3 in. by $\frac{1}{2}$ in. thick, $2\frac{1}{2}$ in. high, wound with 2 lb. of No. 20 on each core; connect in shunt, and drive at 2,500 revolutions, which will give about 20 volts and 3 amperes.

[195] **Castings of Oil Engine.** G. S. (Hammersmith) writes: Could you please inform me where I could obtain sets of castings for oil engine for motor car, with tracing, &c., for same?

For castings of oil engines for motor cars, with working drawings, apply to F. C. Blake, Ravenscourt Works, Dalling Road, Hammersmith, W.; H. Jones, 14, High Street, Lambeth, S.E.; and A. & S. Barker, 361, High Road, Leyton, E.

[193] **Winmshurst Machine.** W. F. (Deal) writes: (1) Please will you tell me how I can make a Winmshurst machine with 24 in. plates, and twelve in number. I have never seen one, so don't know the position of plates, brushes, combs, and the gearing. I should require it for x-rays. I have made a 20 in. one, which gives 7 in. sparks, but I find it does one when I am taking an arm, the exposure being about six or eight minutes, and there is great difficulty in keeping still. (2) What would be the capabilities of the one described? Could I see through the body with a fluorescent screen? (3) At what rate would the power increase with each extra pair of plates? (4) What size spark coil would give the same results? (5) And what battery power would be required to work it?

(2) It is not easy to describe in the limits of a reply of moderate length, the construction of a 12-plate 24-in. Winmshurst. If you will apply to the nearest public library for Gray's "Electrical Influence Machine" you will find at page 218 *et seq.* a full description with

working drawings of the mode of making up such a machine. (2) Such a machine, well made, preferably with $\frac{1}{2}$ -in. ebonite plates, would give easily 12-in. sparks, and would enable you to illuminate the largest tube made. (3) The power does not increase very greatly with the increase in the number of plates, but the continuity of discharge is greatly improved. (4) To produce a like effect with a coil the coil should give at least 12-in. sparks, and would require twelve Bunsen's or accumulator cells to work it. The 12-in. spark Winmshurst would enable you to see easily through the chest, with a good screen. The cost of such a Winmshurst would be about £12; of a coil of similar power, £30 to £40.

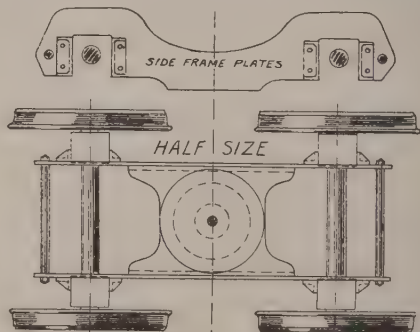
[193] **Engine to Drive Dynamo.** R. D. (Gateshead) writes: Please give principal dimensions of a 20-c.p. Manchester dynamo. The output is 5 amps. at 15 volts. I want the engine to work at 40 lb. pressure.

Cylinder, 2-in. stroke, $1\frac{1}{4}$ -in. bore; boiler (vertical), 7 in. diam., 14 in. high, 1-16th in. thick (copper); firebox, 6 in. diam., 7 in. high, with seven 7-in. tubes (brass), up to chimney; boiler should be rivetted with $\frac{1}{2}$ in. copper rivets, 7-16th in. centre to centre, and joints afterwards soldered; chimney not less than $1\frac{1}{2}$ in. diam.; boiler must have suitable stays for 40 lb. pressure; engine to run at 500 revolutions, steam being cut off at about $\frac{1}{3}$ stroke.

[195] **Grids for Accumulators.** B. J. (Manchester) writes: Will you please give me an answer to the question on pasting grids through the correspondence column of THE MODEL ENGINEER. I succeeded well enough with red lead on the positive plates, but I cannot succeed with litharge. I have your Small book on Accumulators, but it gives no instructions for using litharge.

It is not necessary to use litharge for the negative plates, the plan adopted in "Small Accumulators" being to fill in the negative grids with precipitated lead to save the trouble of "forming." If you do use litharge, mix it with diluted sulphuric acid exactly as in the case of the red lead for positive grids, making a very stiff paste which must be worked into the grid on both sides.

[192] **Midland Loco.** F. C. G. (Aston) writes: (1) Could you give me a sketch of the bogie frame of a $\frac{1}{2}$ in. scale Midland locomotive, showing the arrangement of springs, axle-boxes, pivot, etc. (2) Please also explain and give sketch of how to make the screw-link reversing motion for above engine. (3) Does the bogie frame have separate sliding axle-boxes for each wheel or only one central spring for the whole bogie frame? (4) You L. & S.W.R. loco bogie, on page 66 of the February issue of THE MODEL ENGINEER, shows very clearly the arrangement of springs, &c. (5) Details of the screw-reversing gear may be found in back numbers of the Railway Engineer or other engineering papers, which may be con-



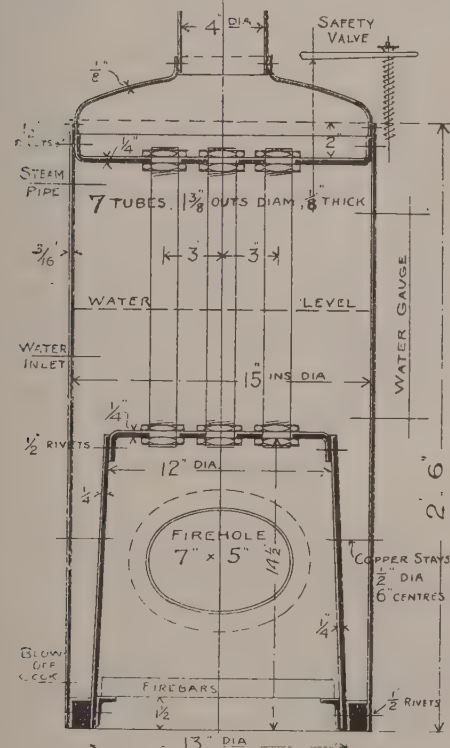
sulted free at the Patent Office Library, Bishop's Court, Chancery Lane, between 10 a.m. and 10 p.m. (3) The bogie frame has sliding axle-boxes, side controlling springs, and bearing springs. (4) 1-32 in. thick will do for $\frac{1}{2}$ in. scale model, if boiler be brazed or rivetted. Inner firebox plates 1-16th in. thick. Tubes slightly expanded into tube plates and brazed in. (5) No 1 boiler half the size of Mr. Alcock's would be too small. One the same size would not be too large for the size of engine.

[186] **Collectors for Winmshurst Machines.** "CONDENSER" (Mile End) writes: In February issue of THE MODEL ENGINEER an article appeared on "Collectors for Winmshursts." (1) 14-in. plates, $\frac{1}{4}$ in. apart, with sectors and small condensers. (2) 13-in. plates, $\frac{1}{4}$ -16th in. apart, without sectors, but large condensers. I have sketched out a machine, having 15-in. plates (well varnished window glass) $\frac{1}{4}$ -16th in. apart, and four large condensers, sector-

less, similar in respect to No. 2, having the thin steel wire. Do you think it advisable to make one on these lines, or whether you can suggest any improvements? The length of spark is required (No. 2 gave $\frac{1}{2}$ in. to $\frac{5}{8}$ in. spark, see THE MODEL ENGINEER for February). What is the inter-plate collector? I have read that the nearer the plates (of opposite rotation) the better the output, and that Leyden jars are in no way necessary to the good working of the machine. Is this correct? Where can I procure large bottles for Leyden jars, and what size will be found to be suitable? Will glass bottles similar to those seen in confectionery shops (holding probably 7 lb. sweets) suit? I propose using four large Leyden jars, two at each end of machine.

Your design is correct, and the machine well proportioned. If you wish for long sparks, use jars coated to two-thirds of the total height. If for a continuous dense spark, coat only one-third up. Large bottles are not advisable; about 20 in. by 2 in. is ample. You can get white jars from Powell's, of Tudor Street, E.C., but the best jars, electrically, are certainly the Lucca Oil bottles (pint size) sold by Lazenby. The interplate collector is simply a piece of wire bent on itself, with its extremities bent outwardly towards the plates, like a letter Γ .

[1185] **Vertical Boiler.** J. O. McV. (Fife) writes: Will you kindly give me drawings of a vertical steam boiler suitable for a horizontal steam engine, bore of cylinder $1\frac{3}{8}$ stroke, stroke $3\frac{1}{2}$ in. Please give them, showing construction and where to place fittings, also dimensions.



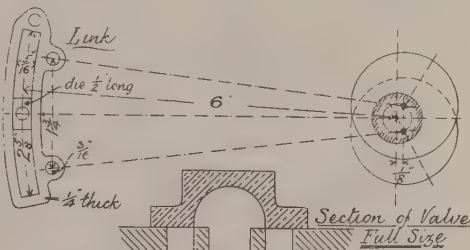
Above is a rough sketch of vertical boiler suitable for supplying steam to your engine. Boiler pressure 60 lb. on the square inch.

[1182] **Model Locomotive.** A. N. (Cardiff) writes: I am making a model loco, 13 in. long with boiler $2\frac{1}{2}$ in. $\times$ 9 in., firebox $2\frac{1}{2}$ in. $\times$ 3 in., with five $\frac{1}{2}$ in. tubes in it. Would a pair of cylinders $\frac{1}{2}$ in. $\times$ 1 in. be strong enough to drive it? It will have four coupled wheels, 3 in. in diameter; also, what would the gauge of wheels be?

Your boiler would supply steam to a larger pair of cylinders, say $2\frac{1}{2}$ in. bore, $1\frac{1}{2}$ in. stroke; but the size quoted will no doubt do very well. Gauge of rails about $2\frac{1}{2}$ in. The exact gauge may depend on whether your wheels have to be far enough apart to clear firebox, but $2\frac{1}{2}$ in. would probably allow for that.

[1195] **Link Reversing Gear for Launch Engine.** J. S. (Bristol) writes: Would you be kind enough to inform me regarding the following queries of the link motion reversing gear for a single cylinder launch engine, $1\frac{1}{2}$ in. bore, $2\frac{1}{2}$ in. stroke. (1) I wish to have the two eccentrics cast in one, would they be (dead) opposite one another or not? (2) What will be the stroke of the eccentric valve, and the size of the valve, and the exhaust under the valve? (3) Would you please give the right size for the main link, viz.: width and length of slot, thickness of link, size of eccentric rod pins? The sizes of ports are: exhaust $\frac{1}{4}$ in. $\times$ 1 in., steam $5\text{-}3\text{ and }1\text{ in.}$ bridges between ports $3\text{ and }1\text{ in.}$ wide.

(4) The eccentrics can be cast in one piece, but will not be opposite each other relative to the shaft, but at the angle shown in sketch.



(c) Travel of valve, $7\text{-}16\text{th in.}$; length, $15\text{-}16\text{th in.}$, allowing $3\text{-}32\text{nd in.}$ lap each side of steam ports; width of valve, $1\frac{1}{4}\text{ in.}$; exhaust cavity, $7\text{-}16\text{th in.}$ $\times$ $\frac{1}{4}\text{ in.}$ deep, and same width as the ports. (3) Link is shown full size in sketch, make it $\frac{1}{4}\text{ in.}$ thick all over, pins for rods, die, &c., $3\text{-}16\text{th in.}$ diam.

Amateurs' Supplies.

[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateurs use.]

Model Making for Inventors.

On the occasion of a recent visit to the works of Messrs. Thorpe and Salter, 17, Red Lion Street, Clerkenwell, London, E.C., we found them very busy with a big order for Maskeyne's automatic lavatory locks, of which they are the sole makers, in addition to a number of models and experimental jobs for inventors. Among the patentees' models they have already turned out, we learnt of such diverse articles as rat-traps, pipes, kettles, brakes, bicycle saddles, chainless bicycle, tie-clips, pneumatic umbrella, cigar cutters, golf scorers, extension cranks, window fasteners, fret saws, &c. Messrs. Thorpe and Salter made the original models for the Maskeyne typewriter, and also the telescopic cinematograph camera used by the Rev. J. M. Bacon in India for recording the eclipse of the sun. As this firm not only make models and conduct experimental work, but can also make the necessary dies and tools for manufacturing interchangeable work in quantities, they are in a position for handling suitable inventions with much advantage to the patentee. We understand that the "Ruby" small-power gas engine they recently placed on the market is giving general satisfaction.

The Stirling Co.'s Electrical Goods.

The numerous enquiries for galvanometer parts, as described in our May issue, which have reached The Stirling Co.'s Electrical Supply Co. from English readers of THE MODEL ENGINEER have decided them to appoint Mr. C. W. Watling, junr., of View Terrace, Dearnley, near Rochdale, as agent in this country for their goods. Mr. Watling will be pleased to send particulars of the sets of galvanometer parts or other electrical goods, supplied by his firm, to any of our readers on application. He can execute orders direct from stock.

A New Polishing Paste.

Under the name of "Cremolin," a new polishing paste is being introduced into this country, which should find much favour with model makers for putting the final polish on brass, copper, or other metal parts or fittings which require an extra bright finish. It is also capital stuff for cleaning up metal work which has become dirty and tarnished, for which purpose we have given it a very thorough trial. A large size tin only costs a penny, so it should be cheap enough to please everybody. It can be obtained from Messrs. Lucas & Davies, 67, Farringdon Road, London, E.C. Country readers should, of course, send an extra penny stamp for postage.

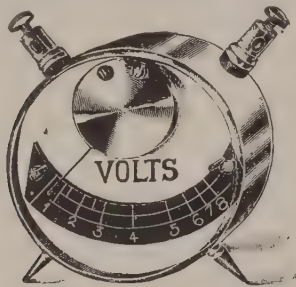
Small Dynamos.

We recently received a small dynamo for trial from Mr. A. W. Roy, 121, Shilwell Road, Newcastle-on-Tyne. We tried the machine at various speeds from about 3,200 up to 5,500 revs. per minute, the output at the former speed being 2 volts and 1-10th of an ampère, while at the latter speed the machine gave as much as 8 volts 3 amperes. This speed, however, is rather excessive for fair working conditions, but at 4,100 revs. per minute the machine gave 6 volts

1 ampère, which we regard as a satisfactory normal output for a dynamo of the size under trial. The general workmanship and finish of the machine are decidedly good, and we do not doubt that those who invest in one of these little dynamos will be pleased with their purchase. Mr. Roy will send full particulars on application enclosing stamp for reply.

Cheap Volt and Ammeters.

Messrs. F. Darton & Co. send for our inspection a compact little voltmeter, which they are supplying at the very moderate figure of rs. 6d. Every young electrician knows the need of such an instrument for testing batteries, accumulators, and dynamos, and the difficulties in the way of making so delicate a piece of apparatus



render a cheap reliable article a blessing to the amateur. We believe these instruments are quite accurate, and they certainly have a neat, well-finished appearance. The particular type before us registering from 0 to 8 volts, but these instruments can be made for any ordinary range of readings at a slight increase in cost. Messrs. Darton's address is 142, St. John Street, Clerkenwell, London, E.C.

For Model Locomotive Builders.

A specimen model spring buffer and a brass chair for model track have been submitted by Mr. H. O. Drake, 35, Heath Street, Hampstead, London, N.W. The first of these articles is a well-made brass buffer with a smooth black finish, which would certainly look very well on a model engine. With the exception that rather too great a stroke is given to the plunger—a defect which could easily be remedied—the pattern is quite similar to that in use on many lines. The price is 3s. per pair. Mr. Drake will be remembered as the inventor of the model rails pressed from brass tube, which have an exact resemblance to the real bull-headed rails in use. The chair supplied is a clever imitation of the railway chair. It is punched from sheet brass, requires no filing, and can be supplied at very cheap rates. It is, of course, specially adapted for use with the brass rails previously mentioned.

Clearance Sale of Castings.

Messrs. Reynolds Bros., 38, Pitt Street, Barnsley, Yorks., inform us that they have acquired the business of Mr. W. Totty, formerly carried on at Staincross, Barnsley, and are now selling off his stock of model engine castings at reduced prices. These include vertical or launch engine sets, cylinder castings, fly-wheel castings, and horizontal engine sets. A list of prices and sizes will be sent by Messrs. Reynolds Bros. on receipt of stamp.

The "Manchester" Electric Bell Set.

Much has been done of recent years to simplify matters in such things as electric bell fitting, and it is not too much to say that any one nowadays is common enough to fit up an electric street door bell without fear of failure. It is undoubtedly the simplest plan to purchase a complete set, where the battery and bell are fitted on a baseboard ready for immediate fixing. Such a set is the "Manchester" Electric Bell Set, supplied by the Manchester Electric Co., Manchester. The purchaser of one of these sets has the further advantage of choosing either a 2½-in. ordinary bell or a 2-in. sheep song bell. The remaining parts are one "British" dry battery, one 2½-in. wood push, 12 yards of double wire, and all staples, screws, etc., the bell and battery being mounted on a polished baseboard. Instructions for fixing are enclosed, making a thoroughly complete and handy set. The instruments and batteries are of the best English manufacture, and the price charged, viz., 6s., must be considered remarkably cheap.

Catalogues Received.

Lonsdale Bros. (Dept. H.) Green Lanes, Harringay, London, N. — This is a catalogue of apparatus, which, primarily appealing to photographic readers, will be of interest to a great many others besides. For the amateur camera maker the list should be a treasure, containing as it does every variety of fittings for cameras, dark slides, tripods, lanterns, hand cameras, &c. All these are fully illustrated and indexed and quoted both for finished and rough. As we have stated, however, the list appeals to a wider circle. Amateur

engineers will peruse its pages with profit, for many useful tools such as screw plates, files, fret and other saws, drilling frames, soldering irons, all find places therein. Many useful hints lie scattered through the pages, and the possessor of Messrs. Lonsdale's catalogue will have at hand a book of recipes for lacquering brass, soldering, cleaning and polishing metals, tempering drills, soldering aluminium, and so on. An article on "How to Make Camera Bellows" is included, and every list is provided with a Prize Competition Coupon which entitles the reader to compete for valuable prizes. The price of this catalogue is 3d., or post free 4d.

S. Hicks & Co., Ltd. Mill Mount, Maldon, Essex. — A number of lists are to hand from this firm, which shows at a glance the extensive nature of the business done, and illustrate some specialities. It is stated, however, that any tool can be promptly supplied from the large and varied stock in hand. The chief speciality is a line of paraffin stoves and blow-lamps adapted to a large number of uses. They range from an oil cycle brazing stove to blow-lamps for heating soldering irons, melting metals, heating and cooking purposes, and these are stated to be very economical. These stoves have been sent to all parts of the British Isles and Colonies, and appear to have given satisfaction. Cycle builders are well catered for, but all tool users will do well to send a stamp for lists of their particular requirements. **THE MODEL ENGINEER** should be mentioned.

J. T. Jarratt, East Short Street (Queen Street), Leicester. — This is a clear and concise price list of lathe and other machine tool castings of Mr. J. T. Jarratt's manufacture. A very wide selection of parts can be supplied, and those of our readers who contemplate building their own lathe, or making additions to their present tools, will be well-advised in consulting this catalogue. Several special lines may be noted, such as castings for a 6-in. self-acting shaping machine, fans suitable for small forges (these fans being supplied either finished or in parts, unfinished), lathe driving wheels, ice-plates, carriers, &c. For those owning screwcutting lathes, a very complete list of change wheel castings will prove of use. The price of this excellent catalogue is 2d. post free.

W. H. Baughan & Co., 8 and 10, London Street, Reading. — Catalogue No. 99 contains particulars of a large variety of electric bells, telephones, speaking tubes, magneto machines, dynamos, motors, electric light sets, lightning conductors, &c. The list is very fully illustrated, and in addition to the above mentioned apparatus, an endless variety of smaller items find a place. Pushes in all shapes and sizes, batteries, accumulators, coils, and other electrical supplies interesting to the amateur, will be found in these pages. Messrs. Baughan also make and supply apparatus for the generation of acetylene gas in large or small quantities, and have various other specialities. This useful list will be sent to readers of **THE MODEL ENGINEER** upon the receipt of 4d. post.

J. H. Heathman & Co., 37, Endell Street, Long Acre, London, W.C. — The Patent Extension Ladders manufactured by this firm are well known for their portability and adaptability to varying heights, many examples of their special uses being noted in a well-filled list before us. A large variety of other ladders, hose, fire appliances, pumps, buckets, etc., are described and illustrated, making altogether a very comprehensive guide. The catalogue will be sent, post free, to any reader mentioning **THE MODEL ENGINEER**.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 3s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to **THE EDITOR**, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All correspondence relating to advertisements to be addressed to the **ADVERTISING MANAGER**, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All subscriptions and correspondence relating to sales of the paper to be addressed to the publishers, **Dawbarn & Ward, Limited**, 6, Farringdon Avenue, London, E.C.

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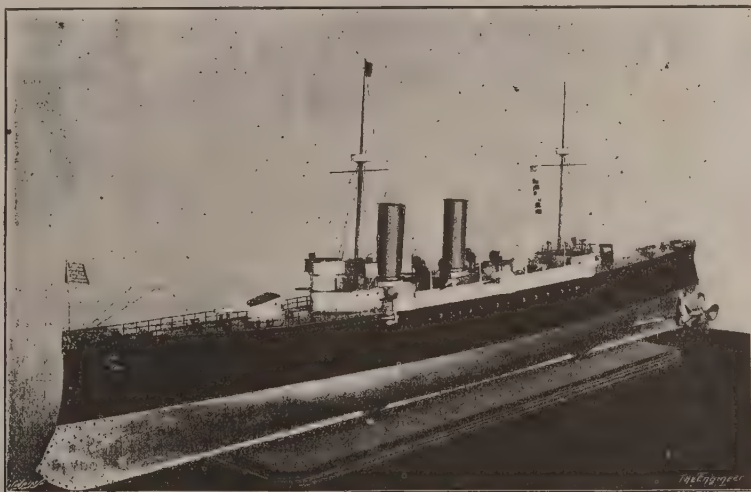
PUBLISHED
MONTHLY.

A Model Cruiser.

THE following particulars refer to the *Tigress*, a model cruiser built by one of our readers, Mr. Chas. L. Palmer, of Albany, N.Y., U.S.A.:

The *Tigress* is a working model, on a scale of 1-6th in. to the foot, of a twin-screw protected cruiser. She is

screws $3\frac{1}{8}$ in. diam. and 5 in. pitch, giving a thrust of over 2 lb. With the exception of these, which it was found advisable to make larger, outside of the engine-room the scale has been accurately followed. It is evident that to make the usual pair of triple-expansion engines, with their six cylinders and gear, as small as called for by the scale, would entail enormous friction. The machinery, therefore, was designed to meet the con-



THE MODEL CRUISER "TIGRESS."

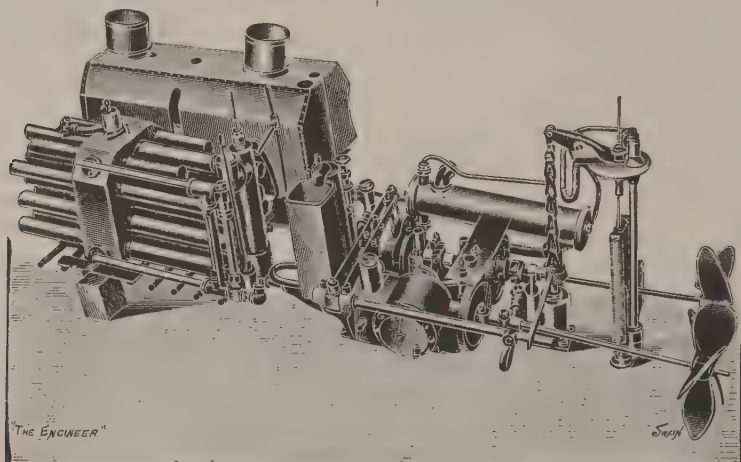
56 ins. long, built of aluminium, and has a surface-condensing engine, and water-tube boiler fired with naphtha. The engine at 1000 revolutions gives a duty of 1,300 ft.-lb. per minute, driving the vessel easily at a speed proportionate on the scale to 23 knots per hour, calculated on the accepted formula of the speed of vessels varying as the square root of their length. There are twin

ditions required, which were (1) low centre of gravity, (2) accessibility, (3), least possible friction, and (4) capability of automatic continuous working with little or no supervision. To meet the first, second, and third conditions, the engine is made horizontal, with a single cylinder. To comply with the fourth a surface condenser is employed, using the same water over and over, thus keep-

ing a steady water level in the boiler without attention; while a naphtha pump, which regulates itself, supplies a constant flow of fuel. To preserve a straight wake without a helmsman, the screw shafts are geared together, turning in opposite directions at the same number of revolutions per minute, incidentally avoiding the heeling unpleasantly marked in some models, caused by the reaction of a single screw. The two propellers also give the excessive blade surface required by screws working so near the surface of the water. The machinery is so designed that it may be readily detached from the boat and lifted out for packing glands, &c. As the whole arrangement is believed to be unique, and has proved very effective, some details may be found interesting to those fond of model construction.

The engine is single direct-acting horizontal, with a small flywheel. The cylinder is $1\frac{1}{4}$ in. in diameter, and $\frac{5}{8}$ in. stroke. There is a steel slipper guide, and ample bearing surface and means of taking up wear throughout. The slide valve, which has a fixed cut-off at two-thirds

side of the hot-well to catch the excess of water which comes over in starting. The hot-well has a fine removable strainer to arrest any chips, &c. This was found important. The engine, condenser, etc., weigh $4\frac{1}{2}$ lb. No special pains were taken to secure lightness in the boiler, as its weight acts as ballast to immerse the screws to the required depth, and gives stability, as it sits very low. The centre is an aluminium bronze casting, cored out, and into it screw thirty-two seamless copper tubes $\frac{1}{2}$ in. in diameter, being of the *Nicholau* type, but without the inner circulating pipes. The upper tubes act as superheaters. There are 170 sq. ins. of heating surface in the boiler. The safety valve is set to blow at 104 lb. per sq. in., and when running is nearly lifting. The steam is somewhat wire-drawn to prevent priming. The jacket, which may be readily removed, is made of ferrotype plate lined with asbestos. The boiler measures $8\frac{1}{2}$ ins. long by 4 ins. wide, and 5 ins. high, and the total weight with burner and water is 7 lb. It holds so little water, and makes steam so rapidly, that it



THE ENGINE AND BOILER OF THE MODEL CRUISER "TIGRESS."

stroke, is faced with nickel working on the aluminium bronze face of the cylinder. Reversing is accomplished by a shifting eccentric. Steel and bronze only are used in the construction. The air, feed, circulating, naphtha, and bilge pumps are worked from a rocking beam driven by a connecting-rod from a crank pin in a gearwheel, which makes one revolution to two and a-half of the engine. This was required, as they would not work satisfactorily at the high speed of the latter. The air pump is $\frac{3}{4}$ in. in diameter by 7-16th-in. stroke, the circulating pump $\frac{3}{4}$ in. in diameter by $\frac{1}{2}$ -in. stroke, and the feed pumps 3-16th in. in diameter by $\frac{1}{4}$ -in. stroke. These are single-acting, and of the usual construction. The surface condenser has twenty-four tubes $\frac{1}{4}$ in. in diameter, and 4 5-32nds in. long, giving about 40 sq. ins. of cooling surface. The water circulates outside the tubes. A vacuum is obtained when running, as shown on the closed top syphon gauge, equal to 20 ins. of mercury.

The engine works the starboard shaft direct. This shaft carries a 2 in. steel gearwheel, which drives a rawhide gear of the same number of teeth fastened on the port shaft. A small square feed-tank is at the

would empty itself in a minute or two in case of failure of the feed pump. This has never happened, but one of the advantages of the peculiar arrangement of burning naphtha over the usual way of having air pressure in a closed tank is that in case of such failure, and consequent stoppage of engine through lack of steam, the fire would go out and not overheat the boiler.

The hull, 54 ins. long, 8 ins. beam, and 6 ins. deep, with a draught of 3 ins., is built of sheet aluminium 1-32nd in. thick. Plans were first made, water-lines, etc., laid down and faired. From the body plan templates were taken, and, guided by these, right and left half models of wood were built. Over these the strakes were beaten to shape. There are three strakes in each side, and each side was put together first by itself, and afterwards the two were united by rivetting. The garboards were flanged to form the keel, and fastened to the middle strakes by butt joints and covering strips, while the middle strakes join the upper ones by lap joints representing the offset of a wood sheathed bottom. Escutcheon pins serve as rivets, and white lead is laid between the seams. Water-tight bulkheads give ample floating capacity when the engine-room is full of water. The deck is white holly. The

weight of the hull alone is 4 lb., and the displacement at regular draught is 20 lb.

In the photograph of the engine the naphtha pump may be seen at the extreme right between the shafts, the tank in which it sits being removed. Next to it are the circulating and bilge pumps worked by the arm on the long rock shaft, at the other end of which is the beam giving motion to the air and feed pumps. The boiler jacket is removed and set at one side to show the construction of the boiler.

For the above particulars and for the illustrations we are indebted to our esteemed contemporary, *The Engineer*. Mr. Palmer has also sent us a photograph of a model locomotive he has built, which we hope to reproduce in our pages in due course.

Some Useful Workshop Wrinkles.

By W. F. SKINNER.

FOR parallel packing and other purposes, the pieces of type metal called "leads" and "clumps" will be found very useful, and a double handful of assorted lengths of each can be obtained from any printer for a trifle. It is very useful when bolting down cast iron, as a piece slipped underneath in a few places, allows the iron to "bed" better by giving a little, and thus obviating the risk of breaking. Printers' brass rule will also be very handy for this or other purposes. Rule with damaged face will suit just as well as new, and can be bought at the price of scrap brass. The thicknesses in general use are 1-48th in., 1-24th in., and 1-12th in., sometimes up to 1-6th in., may be obtained. It must be softened, when required to be bent, by heating and quenching.

When turning uneven work in the lathe by means of a carrier and driver, the click-clack, click-clack is very objectionable, and also when filing up work in a similar way. This can very easily be avoided by simply slipping an indiarubber ring over the carrier and pin of the catch-plate, so as to keep them together. This simple contrivance can be slipped on and off in an instant, and is much to be preferred to tying them together with string. This rubber ring comes in very useful when drilling holes from the back centre. Slip the ring on the barrel, when the drill is touching the work, as far to the right as it will go. Then, when the drill is advanced, the barrel carries the ring the same distance, and thus the depth of the hole is seen at a glance, or can be measured without withdrawing the drill.

Many little jobs that, at first sight, can only be done on the shaping machine, can be done on the lathe. First of all, bolt the work on the largest face-plate the lathe will carry. Then, on the back of the plate, bolt a long screw-driver (with straps), and this forms a capital lever, whereby the metal can be "seesawed" away, even quicker than turning, and the long handle enables one to stop the cut exactly where wanted. By this arrangement the whole of the outer edge of an eccentric strap can be machined—that is, from lug to lug and from lug to rod on either side. It is also quite easy to cut right up to a sharp corner. Always remember to put the work as far away from the centre as possible.

Referring to the article on centering work for the lathe (in the June issue), there is a special centering drill that was not mentioned. It drills and countersinks at one operation, and when the hole is finished there is a little oil reservoir at the bottom. It is called "Slocombe's Patent" centering drill, and can be obtained from the American dealers.

A very handy form of gas blowpipe for the mouth can be made, at a cost of about 1s., that will do almost any job of soldering, and also very small brazing such as required in model work. First obtain a plumber's mouth blowpipe; then carefully bend it like a letter L, but do not make the angle too sharp. Then obtain a piece of brass tubing about 6 ins. to 9 ins. long, and $\frac{3}{4}$ in. diameter. Bore a hole in this piece of tubing about 3 ins. up, so that the blowpipe nozzle can be hooked into it. The end of the blowpipe will then be inside the tubing, and both must be level at the end. Solder up the joint carefully. We then have a T-shape arrangement, the stem being the mouthpiece; the gas is conveyed by rubber piping, and regulated so that the air and gas give the size of flame required. By this blowpipe a full flame 6 ins. long can be blown. Those who take up blowpipe work should learn to keep up a *continuous* blast without pausing to take breath. It is done by filling out the cheeks and breathing through the nose. The first few attempts will result in sucking in the flame, instead of the air. Ordinary brass pins (as used by dressmakers) make capital spelter for brazing, and the writer has used them for the past fourteen years. They are made of soft brass, and the coating of tin makes them melt very easily. A block of coke forms a good bed on which to braise small jobs, and is cheap enough.

For delicate work, such as electric wires, one of the best fluxes for soldering is resin dissolved in methylated spirit. This solution will not affect the work in any way, and no fear need be entertained that the joint will corrode, as is often the case when spirits of salt is used. This is used by the makers of electric blasting fuses.

The Motor Car Exhibition.

At the Motor Car Exhibition, opened at the Agricultural Hall, Islington, on Monday, July 3rd, there were over 100 exhibitors of motor cars and motor cycles. The exhibits included the very latest of the foreign cars, and also a number of heavy lorries, steam and petroleum omnibuses, char-a-bancs, &c. Count de Dion's latest new car was on view, as also a combined land-and-water motor vehicle, in addition to numerous other machines never seen in this country previously. The centre of the hall, 320 ft. long by 100 ft. wide, was used as a demonstrating arena, and throughout the day cars driven by electricity, steam, and petroleum, carried passengers round on trial trips. The exhibition has been promoted by Messrs. Cordingley & Co., proprietors of the *Motor Car Journal*, and formed the largest yet held. During the exhibition, fifteen different commercial efficiency trials were arranged, some of them extending over 150 miles. Among the cars on show was one made by Mr. F. C. Blake, of Ravenscourt Park, W., whose name will be familiar to our readers. This was driven by a petrol motor, and besides being notable for several improvements in the gearing and framework, was decidedly the quietest-running petrol car in the exhibition. We had a capital spin round the arena in this vehicle, and formed a high opinion of the merits of Mr. Blake's work. The curiosity of the show was a safety bicycle fitted with a small wind motor on the steering head; the idea being that a head or side wind would thereby aid in propelling the bicycle. The wind motor is connected by a shaft and bevel gearing to the crank axle. We suppose the next step in the development of this idea will be to fit a water-worked propeller at the bow of a steamship to help the vessel when running up stream against a tide. At any rate, we present this suggestion to the inventor of the wind-motor cycle gratis; there is quite as much mechanical sense in the one idea as in the other.

A Model Electric Motor-Car.

By G. H. ROOKE.

(Continued from page 130.)

The Wheels.—The front wheels are 3 ins. in diameter, the rear 4 ins. The patterns should be made from some hard wood, as beech; the rim and hub being turned up in the lathe. The part between these from which the spokes are cut should be turned to a thickness of $\frac{1}{4}$ in. I cut the spokes out by means of my treadle fretsaw, the table of which was tilted to a few degrees. This gives the tapering form to the spokes, but one should be most careful to always cut in one direction. Finish up with rasp and sandpaper; then send them to the brassfounders. On arrival of castings, bolt them on face-plate of lathe, and drill a 3-16ths in. hole through the hubs, tapping this

result. The wheels should now have the grooves for the tyres turned in the circumference. This groove should be 1-16th in. deep, and a trifle under $\frac{1}{4}$ in. wide. The tyres are cut from $\frac{1}{4}$ in. india-rubber sheet, glued on to a wooden face-plate which has previously been turned up true. Wait till the glue has nearly set; then cut them out with a very sharp turners' chisel, using plenty of water as a lubricant. Each tyre should be 1 in. less in diameter than the wheel it is to fit. The stretching necessary to make them go on reduces its thickness to a shade under $\frac{1}{4}$ in. and also helps to keep them in place. The rim of each tyre should be 3-16ths in. broad, thus letting it project $\frac{1}{8}$ in. above the wheel. Before placing on the tyres turn up the rims nice and smooth finishing off with fine emery paper. The axle for the front wheels should be turned down from a $\frac{3}{8}$ in. rod to 5-16ths in., the screwed ends should be as for the other, but the journals must be 3-16ths in. instead of $\frac{1}{4}$ in. The cogwheel

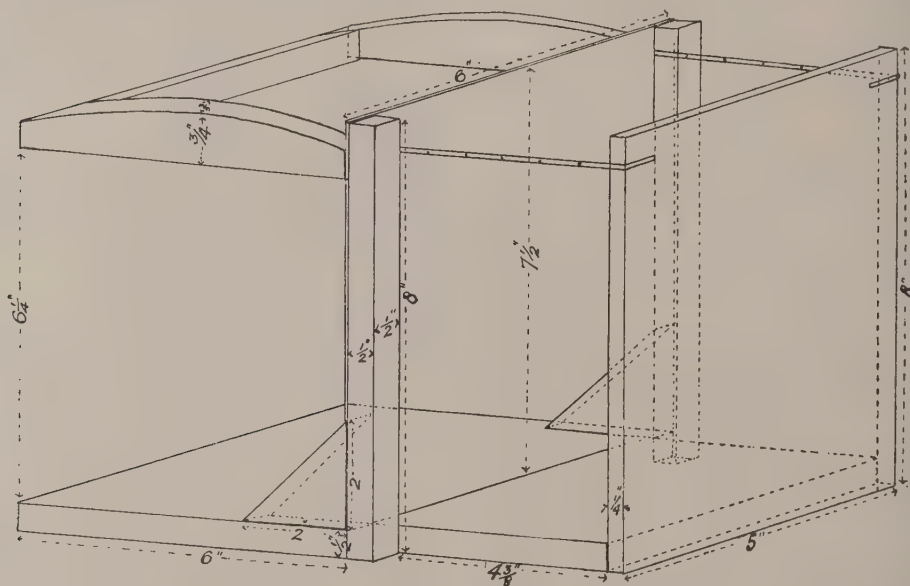


FIG. 7.—SHOWING CONSTRUCTION OF BODY.

whilst in lathe with a $\frac{1}{4}$ in. tap. Now turn up hubs and face of rims. Proceed now with the

Axles.—Truly centre a length of $\frac{3}{8}$ in. steel rod, turn down on both ends a shoulder $\frac{1}{4}$ in. thick of the same length as the thickness of the hubs. Run on these a $\frac{1}{4}$ in. thread whilst the rod is in the lathe, and turn down two $\frac{1}{4}$ in. journals $\frac{3}{8}$ ins. apart (measuring from the centre of journals), sufficiently wide to take the bearings—i.e., $\frac{1}{4}$ in. Of course, these journals must be at equal distances from the centre. Now screw on the wheels with the sides already turned facing each other. I ought to have mentioned that the wheels were bolted to the face-plate with the thicker part of the spokes towards the operator, the outside faces being turned up when the wheels are screwed on the axles. This may now be done, but be careful to avoid the tool catching in the spokes or fresh wheel castings will be the

must now be affixed to this axle. It is 1 in. in diameter and 3-16ths in. thick, having a 3-16ths in. hole; this hole must be enlarged to 5-16ths in., when it will nicely slip along the axle to the centre. (See photograph.) See that it runs true and then solder in position. Turn off surplus solder and polish up axles. Now take the wheels in hand to finish up the spokes. This is perhaps the most tedious part of all. I spent sixteen hours on mine; but it was time well spent, as nothing spoils a model so much as badly formed wheels. Always file from the hub towards the circumference and finish the spokes in pairs, each being opposite to the other. After spokes are finished to satisfaction, carefully file up inside of rims; the hubs may be treated lightly with a rat-tail file. The backs of spokes must be rounded off; a glance at the nearest cab will give one an idea of what to aim at. When finished screw on the wheels to their respective axles, and place them in their proper bearings. These may now be screwed

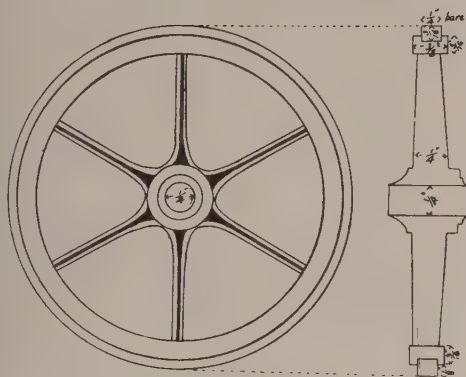


FIG. 6.—WHEEL.



FIG. 10.—SWITCH.

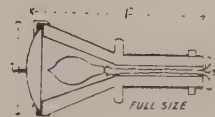


FIG. 9.—ELECTRIC HEAD LAMP.

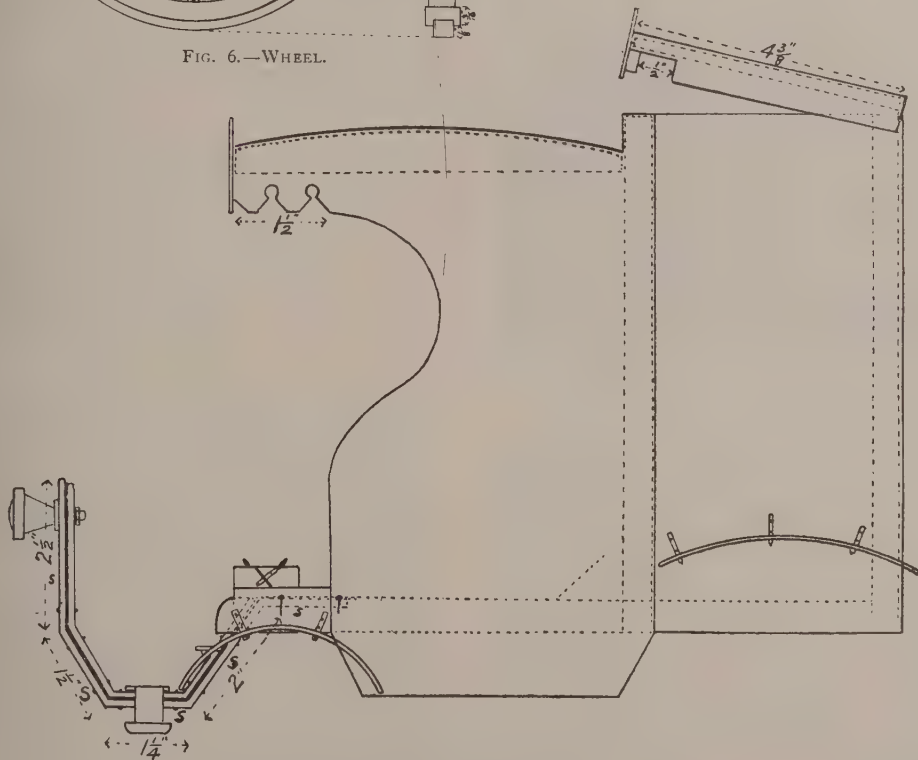


FIG. 8.—SIDE ELEVATION OF BODY.

A MODEL ELECTRIC MOTOR-CAR.

DETAIL DRAWINGS.

(For description see opposite page.)

to underside of baseboard (see Fig. 1), being careful that each of the side wheels is behind the other. Also be sure that the cogwheel engages properly with the worm when the motor is affixed. We are now in a position to see if the motor will do its work properly. Adjust the back wheels as required, place the accumulator on the baseboard, attach the wires, and if everything has been done as explained the affair will run merrily and practically silently. I should advise the gearing to be kept well oiled.

The Cab.—The cab is made of polished sheet ebonite, 1-16th in. thick, which gives it a good appearance and is at the same time light and strong. This ebonite is screwed to a framework by means of $\frac{1}{4}$ in. round-headed brass screws placed about $\frac{1}{2}$ in. apart. The round heads must not be damaged whilst being screwed in, and remember that *all* holes in the ebonite should be drilled, not bored with a bradawl, as this will cause it to split. First make the framework. Fig. 7 will give an idea of this. First make the uprights, of mahogany, $\frac{1}{2}$ in. in section, 8 ins. long; fix the triangular supports $\frac{1}{2}$ in. from the ends by means of screws and glue, so that when fixed in position the ends will be flush with the underside of car. Now cut a piece of cigar boxwood, $7\frac{1}{2}$ ins. long by 6 ins. broad, and screw and glue this to the uprights (see Fig. 7), first cutting out two pieces from the two bottom corners, $\frac{1}{2}$ in. by 2 ins., to enable it to clear the supports. This forms a partition between the battery-box and the inside of cab. At the rear end of baseboard screw and glue a piece of mahogany, $\frac{1}{2}$ in. thick, 5 ins. broad, and 8 ins. long; be sure it is perpendicular. The sides of the box are of ebonite, cut to size given in Fig. 8. To give further support to back, fasten two stays of brass $\frac{1}{8}$ in. wide from it to the uprights near the top. Holes, $\frac{1}{2}$ in. apart, should be drilled in these to pass rivets through, which are made from small brass nails. These rivets fasten the side ebonite to the brass stays, and great care must be taken not to damage it. The wooden back of box must be covered on outside with ebonite, small screws being used to fasten it. The lid of box is of wood, cut to size, and covered on outside with ebonite also. Strips of the same material form the sides of the lid, two small pieces, $\frac{1}{2}$ in. wide, being cut out near one end of each to clear the tops of the wooden uprights. In cutting ebonite, make a fairly deep scratch with point of sharp knife, and placing it over the sharp edge of a drawing board, a little pressure will cause it to break. Finish off the edges with a smooth file in preference to sandpaper, as the latter causes the edge to have a round appearance. The sides of cab may now be cut out to shape given, the top curve having a radius of 10 ins. A template of stiff cardboard should be first made, and then laid on the ebonite, which can be then marked out. A fretsaw should be used to cut out the curves. The ornamental edge should be done last, as the projections are liable to be snapped off. When the two sides are affixed, a narrow strip of wood will be left bare on that side of the uprights facing the rear; this should now be covered with ebonite, fixing the same with screws as before. The framework for roof should now be made from $\frac{3}{8}$ -in. mahogany, the dimensions of which are given in Fig. 7. Of course, the curved portion must be of the same radius as the ebonite sides, *viz.*, 10-in. radius. A couple of screws through the wooden partition will hold it in position whilst the sides of the cab are being affixed to it. Now cut out the roof, warm this gently over a fire till it will bend easily, then hold it in position and screw down to the framework. The ornamental part overhanging the front of the roof may now be made; this should be cut out with a fretsaw and screwed in position (see photograph). The splash-boards for the wheels are $\frac{1}{2}$ in. wide for the larger and $\frac{3}{8}$ in. wide for the smaller. They are cut out of ebonite,

the corners nicely rounded off and bent to shape carefully. To affix them to sides of cab make two L-shaped brass strips $\frac{1}{4}$ in. wide; rivet these to the splash-boards and to the cab sides. Great care must be taken not to split the ebonite. The radius to which the larger pair of splash-boards are bent must be sufficiently large to allow the wheels to turn on their pivot when running in a circle. The front part of car bearing the lamps, steps, foot-board, &c., is held together by two stays cut from $\frac{1}{4}$ in. brass sheet, $\frac{1}{2}$ in. broad, and bent to shape shown in Fig. 8 (r). Both must be exactly alike. Drill a 5-16ths in. hole near the end of each for stem of lamp, and two smaller holes in the other end to take screws to fasten it to floor of cab. Four strips of ebonite, 6 ins. long, must be rivetted to these brass stays (Fig. 8), their edges being bevelled off to make a good fit. Now cut pieces of 1-16th in. brass wire, just long enough to stretch between the stays; place these over the joints of the ebonite strips and solder them in place. Also bend and solder another piece of brass wire to form a rail over the top (see photograph); this soldering must be done very

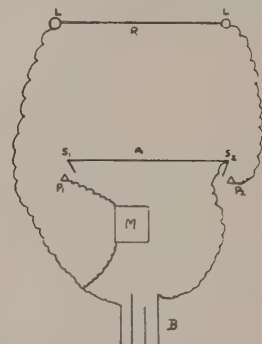


FIG. 11.—CONNECTIONS.

neatly, the surplus being very carefully removed with file and emery cloth. A small brass plate may now be cut out and affixed to front. The pea lamps are 4-volt ones connected in series. Turn up the holder from a piece of $\frac{3}{8}$ in. brass rod to shape and size given in Fig. 9, the stem being screwed $\frac{1}{4}$ in. Whitworth thread, with a brass nut to fit. The cap holds a lens $\frac{1}{2}$ in. in diameter in its place, and is turned from a piece of 3-16ths in. brass sheet. After the lamps are inserted in their holders and secured therein with plaster of Paris; fasten down the caps with same. To avoid too many wires, I have utilised the top rail for connecting the lamps together, one wire from each lamp being soldered neatly to each brass stay, the other two wires being carried down by side of the brass supports to the underside of car. The lamps themselves are kept in their places by the nut screwing on the threaded stem. The seat in front forms the switch-board, and should be made from boxwood, $1\frac{1}{2}$ ins. long, 1 in. broad, $\frac{1}{2}$ in. thick. Screw to each end a brass plate, 1 in. by $\frac{1}{2}$ in. by $\frac{1}{4}$ in. thick; cut this in two by an oblique slit and fill up with a slip of ebonite, making sure each half is thoroughly insulated from the other. Now make two L-shaped switches (Fig. 10, s). These must be rivetted, one on each side of seat, by a stout piece of brass wire passing through the length of seat; this wire also serves as a connection. Make sure the switches make good contact. We have now four brass plates, two of which are connected together by means of the wire axle. Three

wires must now be attached, one to each of the brass plates *not* connected together, and the other to either of the remaining two, it matters not which, but for clearness' sake we will say the one on the left hand of the driver. These three wires must be taken through the floor of the car to the works underneath.

Connecting-up.—Fig. 11 shews the connections: L L are the lamps connected in series by the brass rail R; S₁ S₂ are the switches joined by the axle A: P₁ P₂ are the brass plates upon which the switches make contact; M is the motor, and B the battery. If now S₁ is pressed over to make contact with P₁, the current goes from battery through the motor by switch S₁ to the axle A, and from thence to the battery again. If, however, the lamps are to be lit the switch S₂ must be pressed over to P₂. The current then travels direct to lamps from them to P₂, through S₂, and back to battery.

Accumulators.—There are four of these, occupying a space of 3½ ins. by 4½ ins. ground room, and are about 7 ins. high. Each cell has one positive and two negative plates, and are connected in series. A suitable box should be made for them for convenience in lifting out of the car. The weight of cells when charged is 9 lb. I obtained them from Mr. Avery at the same time as the castings. They are eminently suited for such work. The plates slide in grooves in the glass cells. This keeps them apart, and as they do not reach the bottom of the cells, the chance of their being short-circuited by any paste falling out, is reduced to a minimum. To connect them to the motor, I have placed two strips of brass inside the car along the 8-in. uprights.

Finishing.—The motor may be enamelled any suitable colour, and the brass work lacquered. The "upholstering" may be left to the taste of the maker. Mine has the floor covered with green baize bordered with gold braid. The seat is padded and covered with red; a piece of wood grooved to represent panelling, and secured over the seat (see photograph) gives it a finished appearance. The edges of the ebonite should be painted with gold paint, two coats being sufficient.

The Society of Model Engineers at Brighton.

ON Saturday, July 8th, the above society paid a visit to Brighton, in accordance with the arrangement announced in our last issue. There were present: Mr. Percival Marshall (chairman), Mr. Jas. C. Crebbin (vice-chairman), Mr. Herbert Sanderson (hon. secretary), Mr. W. J. Tennant, and a good muster of members.

The party arrived by different trains, but were all assembled at the Brighton terminus by 10.30 a.m., when they proceeded to the L. B. & S. C. Railway's locomotive and carriage works. Here the members were divided up into three groups, each group being conducted through the works by one of the company's drawing-office staff. The shops visited were the carriage shop, saw-mills, foundry, boiler shop, fitting and turning shops, and erecting and repair shops, many interesting operations being in progress. For instance, in the foundry, some of the members were just in time to see the casting of a pair of cylinders for one of the new express engines, while in the boiler shop the boilers for these engines were in hand, and were closely examined. In the repair shops some curiosity was excited by the presence, under repair, of the engine which recently ran away on its own account from New Cross to Croydon. After concluding the visit to the works, the members adjourned to the running sheds, where they had an op-

portunity of making a close acquaintance with the engines in working trim. One object of much interest in this portion of the company's premises was the new weigh-bridge recently installed for adjusting the proportion of the weight of the locomotive borne by each pair of wheels.

Mr. MARSHALL then proposed that the sincere thanks of the members be accorded to Mr. Billinton and to Mr. Jeffrey for the privileges which had been accorded to them, and said he felt sure that all who were present had been greatly interested by what they had seen.

Mr. JEFFREY replied in a few appropriate and kindly words, saying that he was sorry that owing to the early closing of the works on a Saturday, the visitors had had such a short time at their disposal for going through the various shops.

After lunch, the members proceeded to the residence of Dr. J. Bradbury Winter, where this gentleman's splendid model of the L. B. & S. C. locomotive, "Como," was on



A SNAP-SHOT OF THE MEMBERS.

(Photo. by Mr. S. L. Solomon.)

view. Dr. Winter's private workshop was also open to inspection, and his various special tools and appliances proved most interesting. Since the description of this workshop appeared in these pages (January and February issues, 1898) Dr. Winter has added a Pittler lathe, of which, by the way, he speaks in very high terms; and also a 2 h.-p. "Landell" electric motor for driving his various tools. He gave a practical demonstration of his skill by making some small nuts in front of the members, the whole operation of marking and cutting off the steel, drilling, tapping, turning, filing the flats, chamfering, and polishing a nut only taking him about five minutes. Dr. Winter also showed some very cleverly-designed clockwork locomotives made for a model railway belonging to some friends. These locomotives are unique in that they run at a uniform speed throughout the whole of each journey, no matter what the gradient may be. This novel feature is obtained by means of an ingenious governing mechanism, the effectiveness of which was demonstrated on a length of track laid down in the garden adjoining the workshop. Another contrivance of considerable interest was a speed-recorder for cycles and other vehicles which Dr. Winter has just invented and patented. This is a decidedly clever contrivance, which we feel sure has a big future before it, especially in connection with motor cars.

The members were subsequently entertained to an excellent tea, at which Dr. Winter proved himself to be as thorough in the matter of hospitality as he is in his model-making. Moreover, this function was none the less enjoyable because it was totally unexpected. When the attack on the strawberries and cream had subsided, and the vanishing point of the last piece of cake had been ascertained by careful experiment, Mr. Percival Marshall took the opportunity of expressing the hearty thanks of the members present for the cordial way in which they had been received, and for the very great trouble which Dr. Winter had taken to show them so many interesting tools and models. He proposed that they gave effect to their appreciation by electing Dr. Winter as an honorary member of the society. Mr. W. J. Tennant seconded this proposal, which was then put to the members and carried with great acclamation. Dr. Winter then briefly responded, and said he would be very pleased to accept the position to which he had been elected. He added that he felt amply rewarded for his trouble by the very great and intelligent interest which the members of the society had shown in examining his work.

The party then made a further inspection of the new cycle speed-indicator, and subsequently proceeded to the Central Station, from whence they returned to London by the 7.10 train. Altogether, the day's arrangements were a thorough success, and everybody was highly delighted with the outing.

FUTURE MEETINGS.

The next meeting of the society will take place on Tuesday, August 1st, and will take the form of an evening visit to the machinery and models' section of the South Kensington Museum. Members are requested to meet at 7 p.m. outside the entrance to the Southern Galleries (not the Art Museum) in Exhibition Road.

The following meeting will be held on Wednesday, September 13th, and particulars of the arrangements for this occasion will be announced in our next issue.

BRADFORD BRANCH.—The monthly meeting of this branch was held on July 3rd. Mr. A. P. Drake took the chair at eight o'clock, and, after formal business had been disposed of, the company viewed the exhibits provided. Mr. H. Brearley brought with him finished parts of a model locomotive, which comprised cylinders, steam taps, water gauges, safety valves, lubricators, wheels, and injector. Mr. A. P. Drake showed a set of aluminium castings for a vertical engine. The next meeting will be held on Monday evening, July 31st, 1899, at the Coffee Tavern, Tyrell Street, Bradford, at seven o'clock. All interested in model-making will be welcome.

SPECIAL OUTING FOR BRADFORD BRANCH.—We are pleased to be able to announce that Mr. Fairbank Brearley, Central Engineering Works, Shipley, has very kindly consented to allow the members of the society to go through his engineering works on Saturday, August 19th. Members are requested to meet at Midland Station, Bradford, and proceed by the 3 o'clock train to Shipley, where they will be met by Mr. A. Brearley. Those members to whom it will be more convenient may meet the train at Shipley at 3.15 o'clock.—James H. Lamb, Hon. Secretary, Holly Bank, 109, Rushton Road, Thornbury, Bradford.

SHEFFIELD BRANCH.—The usual monthly meeting of the above was held on Thursday evening, July 13th, at the Y.M.C.A. A fair number of members attended. After the enrolment of fresh members, the question of forming a portfolio and a library for use of local members only was discussed. It was decided that a suitable album should be provided for the purpose of holding interesting photographs of models,

etc., made by members, and that such book should be present at each monthly meeting. Mr. Ellinor was appointed librarian, and promised to submit at the next meeting a practical scheme by which books belonging to members may be circulated amongst other members. The exhibits were now arranged on view. Mr. Shaw had brought with him a model marine engine now in course of construction, a very neat and compact pocket coil and battery, and a new and improved tool-holder for a slide-rest. The latter obviates the necessity of any "packing up," and at the same time gives a very firm grip on the tool. Mr. Firth provided a set of interesting drawings on the construction of model engines, etc., and Mr. Burrows produced an electric motor driven by a portable battery. Amongst other exhibits were Mr. G. H. Rooke's model electric motor-car now being described in THE MODEL ENGINEER, and a steam engine cylinder produced by Mr. Hope.—G. H. ROOKE, hon. sec.

How to Solder Successfully.

By N. R. ENSOR.

THE recent letters and their answers in THE MODEL ENGINEER in regard to the proper method of soldering zinc, led me to believe that a few hints on soldering generally might prove of some value to not a few of the many readers of this journal.

I remember very vividly, though it is some few years ago now, my first attempts at soldering, and I may say they were anything but satisfactory. I noted in some shop window a small box, which, according to the advertisement, contained every requisite for the amateur tinsmith. I purchased the outfit, which cost, if I remember rightly, about two shillings. I joyously proceeded home with my purchase, and immediately set to work to repair the bottom of an old kettle. The box also contained the usual directions for use, but I must admit that, in my ambition, I ignored them to a very great extent, and I may further state that even had I not done so, I should never have obtained the desired result, for the box, as well as others I have seen since, contained nothing but rubbish of no earthly use to anyone. After vainly attempting for an hour to make a satisfactory job, I consigned the whole lot to the rubbish heap.

I never acquired the true art of soldering until I became acquainted with it in an engineering establishment. First of all, then, I should strongly advise my readers to fight shy of the so called "outfits," but invest a few shillings instead in the purchase of a couple of good soldering irons. For ordinary model work two only will be required, one about $\frac{1}{2}$ lb. in weight, the other 1 lb. In choosing them at the ironmongers, see that the copper contains no cracks, for, on being heated continually, they will open considerably, and thorough work is then impossible. A $\frac{1}{2}$ lb. of sal ammoniac (lump) is also required, and a $\frac{1}{4}$ pint of muriatic acid (spirits of salts) will last many months. A piece of sheet zinc and a pound or two of tinman's solder (equal parts tin and lead) will be all that will be required for the present. To make "killed spirits," which is used for most work, pour out about 2 ozs. of the acid into an old cup or some suitable vessel, and drop into it gradually small pieces of the sheet zinc. The acid should not be fed too quickly, but given time to thoroughly eat up the zinc. When it has consumed as much as possible, allow it to cool, and then strain off through a rag into another vessel, when it is ready for use. It is advisable to kill the spirits in the open air, as the fumes have no escape in the workshop, and they are by no means pleasant to

inhale. I would also advise that the raw spirit be kept outside, or at least away from bright tools.

To thoroughly tin the "copper bit" carry out the following directions: First of all anneal by heating to a visible red in daylight and plunging quickly into cold water. Now file up in the vice with a smooth flat file (which should be kept for the purpose) taking care not to leave the four edges and the point too sharp, but nicely rounded off. Heat again, then rub to and fro all faces of the bit on the sal-ammoniac until quite clean, touching it with solder, which will run all over where the bit has come in contact with the sal-ammoniac. When "tinned" plunge sharply in and out of a cup of water, into which half-a-spoonful of powdered ammoniac has been dissolved. This should be always near when soldering, to dip the bit into when it leaves the fire. If this is used and the bit never allowed to become red, it may be used a considerable length of time without having to be retinned. Having got together all we require for ordinary use, let us proceed to do a few pieces of work, or at least superficially.

To fasten a flange, collar, or part of union securely to brass or copper pipe, tin the inside of collar and the end of pipe by heating, and alternately applying killed spirits and solder. While both are hot, slip collar over pipe and hold in a vertical position and allow solder to flow freely all round, wiping off the surplus with a piece of waste. As the metal cools it will contract, leaving a perfectly tight joint which will hold all the steam a model boiler generates. The joint may be finished with a strip of fine emery cloth, and not a particle of solder will remain visible. In the foregoing experiment, the soldering bit has not been called into requisition, for, technically speaking, the collar was "sweated" on, and not soldered. A pair of rod or other brasses that need to be bored out in the lathe should be fastened together in like manner and broken apart after being machined. Of course, it will be understood that the faces should be machined or filed smooth first.

Soldering zinc is not such a difficult feat as some of my readers suppose. The first attempts at thin sheet zinc may prove failures, but after a little practice in the use of the "bit," no more need occur. Use fresh raw acid and a small soldering-iron, being careful that the latter is not hot. Take a "clip" of solder by sliding one edge of the "bit" across the stick of solder, which should rest on the bench. The "bit" should be held horizontally, using the edge for soldering and *not* the point. No weight must be borne upon the work or the zinc will melt. Heavier gauge zinc is much easier to work. The "bit" may be used much hotter and the solder run well into the zinc. It makes a hard joint and an almost unbreakable one. To finish, a plumber's scraper should be used, and the solder may be taken off flush with the zinc without weakening the joint to any great extent. In soldering copper, the articles should be tinned first where they are to be joined, and the same may be said of brass if a satisfactory result is expected. Killed spirits should be used in both cases.

The most difficulty will be found in soldering cast-iron, but it is by no means impossible to make a thoroughly good job. First clean off all excrescences with a coarse file, and if the surface to be tinned is very dirty, raw muriatic acid should be left on ten or twelve hours and then washed off with water. If the article is of any weight it should be heated before being tinned, otherwise the bit is too readily chilled. Tin with killed spirits, of which, it may be remarked, a good quantity is generally required before a good surface is obtained. Make the joint in the usual way. Wrought iron is dealt with in the same manner, but less trouble will be found with it. Clean with raw spirits, and tin with killed. Great care must be used in soldering lead. A perfectly clean surface

is essential, and in this case muriatic acid in all forms is dispensed with, and powdered rosin used as a flux instead. Experience will teach which part of the bit is best adapted for the work. The flux for galvanised iron is acid in the raw state, which should be wiped off with a damp cloth immediately after the soldering is done; in fact, all work should be cleaned, and not a trace of the spirits left.

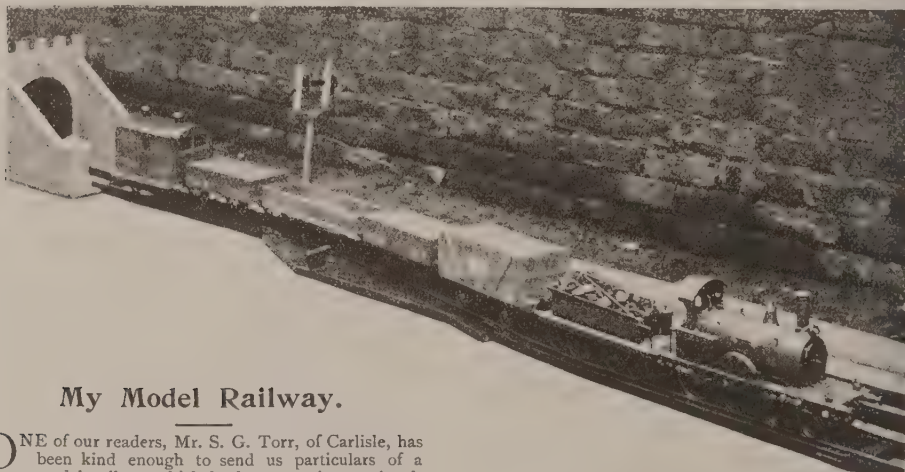
Now a word or two as to tinning. The fluid necessary is killed spirits and a piece of lump sal-ammoniac (about 1 oz. to the pint) dissolved in it. Block tin must be used in place of tinman's solder, and a piece of clean cotton wool completes the list of requirements. To tin, for example, a dome casing, hold by the inside by a piece of wood driven or wedged in. Heat over the gas or forge, and before applying solution, wipe off the smoke with waste, tin all over roughly, then heat again; apply more acid and tin, wipe in a circular motion with the cotton-wool, and when perfectly smooth, plunge into cold water. Repeat operation if necessary.

In conclusion, I may state that if the best possible results are desired, it is folly to set about any work until it has been thoroughly cleaned, and always bear in mind that it is useless attempting a job with a cold iron. If the above hints are taken advantage of and are combined with a little discretion, soldering will become a pleasure, and we shall not see so much good work disfigured by ugly patches of solder, which no amount of paint can hide from the observant eye.

A miniature telephone is the aid to impaired hearing, devised by Mr. F. H. Collins, a Massachusetts inventor. A small receiver, adapted to be inserted into the passage of the ear, is connected by wires with a small transmitter worn upon the breast, and with a battery and induction coil carried in the pocket.

Comparatively few people, says the *Golden Penny*, know that by the Admiralty's orders perfect models are made in paraffin wax of every new battleship before it is laid down, and these models are tested in a tank at Haslar. The models are from 12 ft. to 24 ft. long, and the tank is 400 ft. long and 20 ft. wide. The models are made of wax because it is a material which does not absorb the water or change its weight, so alterations can easily be made; also the material can be melted up and used again. The American naval authorities also have models of all their hulls constructed, but these are much more elaborate than ours, being formed of white pine, and fitted with rudders, false keels, propeller shafts, and all etceteras.

Several lots of apparatus, formerly the property of the late James Nasmyth, the eminent engineer and inventor of the steam hammer, were recently sold by auction. The apparatus was until (and for some time after) Nasmyth's death, in 1891, at Hammerfield, Kent. The principal lots, according to the *Hardwvareman*, included an astronomical telescope, 20 ins., mounted on massive iron frame and cast-iron turn-table, with all fittings and gears for elevating and rotating, made by Nasmyth himself, and represented on page 352 of his "Autobiography." It sold for 10½ guineas. The following five articles were purchased for the South Kensington Museum: Cast of the moon mountain, and an oil painting of a sun spot and a willow-leaved photosphere, £5 10s.; a massive hand-planing machine for metal, on cast-iron stand, with cross slide and automatic feed and pulley for power driving, by Nasmyth, 14 guineas; a well-made small hand-shaping machine, automatic feed, heavy gun-metal wheel, and gun-metal attachment for circular work, by Nasmyth, £3 13s.; and a copper-plate printing press, by Nasmyth, £4.



My Model Railway.

ONE of our readers, Mr. S. G. Torr, of Carlisle, has been kind enough to send us particulars of a model railway which he has recently completed. He writes :

It is now some eight years since I took an interest in model engines, and then it was for the benefit of my eldest son (now 15) who took a great delight in engines, etc., and I must now confess that it is also a source of very great pleasure to me. I may mention that I am in the legal profession and have never had any practical or other knowledge in mechanics or railway building in my life, and my only workshop has been my own kitchen table with a very few ordinary tools, and that I am therefore an amateur in every sense of the word. I have never had anyone to give me any information in any shape or form, and I have not even had the privilege of being able to go to a practical model engineer, for there is not one, to my knowledge, within nearly a hundred miles of here. The engine and tender (all bright brass) is entirely my own design, and every part of it (with the exception, of course, of the cylinders, wheels, &c.) have been made under my own supervision and direction by an ordinary workman in an ironmonger's workshop. The carriages, guard's van, trucks, and goods van, are entirely my own design and made by myself with the help of my son. We also made and laid the whole of the railway lines and points, crossing, etc.

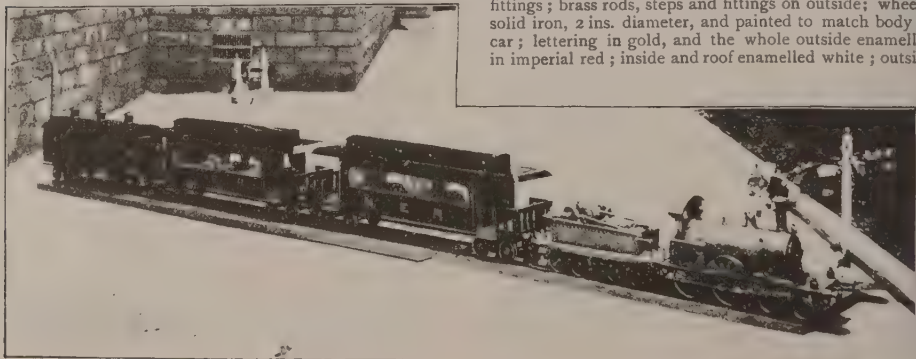
As the whole of the railway crossings, points, tunnels, &c., are not shown in the photos, I have prepared the following brief description of the various details of the line:—

Engine.—Bed-plate—15 ins., width 5 in.; boiler—9½ ins. by 3½ ins., six copper tubes, fire and smoke boxes, the whole copper rivetted; driving wheels, 3½ ins. diameter; bogie wheels, 1½ ins. cylinders, ¾ in. bore, 1 in. stroke; height to top of funnel, 9 ins.

Tender.—Length, 12 ins.; width same as engine; wheels, 2 ins. diameter, on two 4-wheel bogies, imitation brakes, etc.

Entire length of engine and tender from buffer to buffer, 2 ft. 4 ins. Heated by atmospheric spirit lamp of my own design.

Saloon Carriages (2).—2 ft. 6 ins. long, 6 ins. wide, on two 4-wheel bogie carriages (spring) of my own design, extended roof showing red windows above main roof. Window curtains (on brass rods and rings), old gold silk. Seats of first carriage of scarlet silk plush; floor laid with peacock blue cloth. Second carriage: Curtains, old gold silk; seats in sky blue silk; interior carpeted with crimson silk plush, outside balconies with peacock blue cloth; door each end with blue glass windows, brass hinges, and fittings; brass rods, steps and fittings on outside; wheels, solid iron, 2 ins. diameter, and painted to match body of car; lettering in gold, and the whole outside enamelled in imperial red; inside and roof enamelled white; outside



roof black. Centre couplings, hooks, side chains and buffers of brass.

Passenger guard's van to match cars, length 21 ins.; inside enamelled white. This and the cars can be lighted with small oil lamps, thus showing three red lights at back.

Total length of train, as shown in photo., just over 10 ft.

Goods Trucks and Van, each 12 ins. long (exclusive of buffers), enamelled inside cream colour, outside light slate, lettering and numbers white, brass fittings and wheels, black buffers; the van doors glazed, and can be lighted with oil lamp, showing red lights at back; springs and brakes.

Signals.—Double brass ladder, brass spring levers; arm, one side red and black, the other side white and black; lamp (oil), light showing red and green disc.

Tunnel.—8 ft. long, pillars, retaining wall and entrance castellated; painted to represent stonework.

Track.—Gauge $3\frac{1}{2}$ in., of $\frac{1}{4}$ in. square iron rod, drilled and screwed to 6 ft. lengths, 9 ins. wide, and all enamelled green. Total length of rails between 60 ft. and 70 ft. Also circular track 48 ft. circumference. Train worked from central boiler, 10 ins. diameter, 2 ft. high, pressure to 120 lb.

I may say my wife upholstered the carriages. The engine is so constructed that I can take it all to pieces.

Jottings.

MR. G. HAYLER, whose name will be familiar to many readers as the maker of the "Lipton" engine, described and illustrated in the April number of *THE MODEL ENGINEER* last year, has sent us another and still more striking example of his ingenuity. This time it is a traction engine with the alliterative *soubriquet*, "Motor Mustard"—derived from the fact that the boiler was originally a $\frac{1}{4}$ -lb. mustard tin, which still bears its distinctive colouring. Amongst other odd trifles which go to make up this curious model may be cited the lamps, made from two thimbles; chimney, an umbrella top; crank, a piece of galvanised wire; and various wheels made from the lids of mustard and other tins. The model was exhibited at a meeting of the Society of Model Engineers, and much interest was taken in it.

According to *The Engineer*, the North-Eastern Railway now have running two new express passenger engines, which, it is stated, are the largest and most powerful in this country. They are the first of ten of their class, and are designed to meet the increased weight of the main line passenger traffic. They have six wheels coupled, with a four-wheeled leading bogie; the cylinders have a diameter of 20 ins., and a stroke of 26 ins., while the boiler pressure will be 200 lb. per square inch. The engines have been built at the Gateshead works of the company.

The following account of an apparatus for signalling between the signalman and a driver was given in a recent number of the *Golden Penny*. Mr. Wynford Brierley, of Carr Hall Villa, Nelson, Lancashire, has applied himself to the question of an apparatus for communication by signal between signalman and engine driver. The engine carries its own signals with it, and the driver cannot mistake them. They are near to him, they are clear, and he

can rely upon them. The method is about as simple as anything of this kind can well be. A contact bar is mounted on the side of the rails on a rocking shaft, and it is connected by a lever and wire to the ordinary signal connection, so that when the signal is put to danger by the man in the signal box he also raises the contact bar into a position to strike a lever affixed to the engine. The blow when it takes place makes a complete electric current, sets an alarm bell ringing on the engine, and works an indicator. The lever on the engine is held vertical by a very ingenious and novel volute spring with coils in opposition to each other, hence it can be operated in either direction. This spring successfully overcomes the impact on the lever, and after a series of quick oscillations the lever returns to its normal position, and is ready for the next contact bar. The contact bar near the rails has two ends, the higher one for danger, the lower one for safety. The engine has two contact levers, one for danger and one for safety. The safety lever has its own independent electric circuit, and it moves an indicator on the engine. The danger bell continues to ring until reset by a simple apparatus which also acts as a bell tester. The safety bell rings for two or three seconds, and shows the word "safe" on the bell. The bell ceases to ring in this case as the lever ceases to oscillate, and the word "safe" disappears. There is also another type of bell, if preferred, with only one window, opposite which a red disc appears to denote danger, and a white one for safety. The driver has thus a distinct signal given to him as to the position of the ordinary signals, whether for or against him, all along the line, whether he can see them or not. The driver who has been brought to a standstill by the danger bell and indicator must obviously have a signal when to move again. He is near the signal post, however, and a bell on the post worked by the signalman gives him his cue by a very simple code. There are many other purposes which Mr. Brierley's invention serves. Trials have been made on an express train on the Great Northern Railway for close upon eighteen months with the apparatus, and with a thorough success. A section of twenty-five miles has been laid down for the satisfaction of the Board of Trade, and when Colonel Yorke recently made a thorough inspection of the invention he spoke in very high terms of it.

A young Frenchman has invented a primary cell, says the *Electrical Review*, which is said to give 13 amperes at 2 volts for a longer time than the ordinary bichromate cell or the Bunsen cell. Its essential characteristic is that a vanadium salt or vanadic acid is contained in the exciting fluid or in the substance of the negative or positive electrode. Such an element consists preferably of an external vessel containing a solution of 20 parts of NaCl to 100 parts of water, in which an amalgamated zinc rod is dipped; an inner porous jar for the reception of a carbon plate, and which is filled with a mass of powdered manganese oxide and fused vanadic acid. This jar contains also a solution of sulphuric acid, vanadic acid, and hydrochloric acid. Ten per cent. of sulphuric acid may also be added to the NaCl solution in the external vessel. The depolarisation is very energetic on account of the combined action of the hydrochloric acid, the oxygen, and the chlorine. Moreover, the reducing effect of the hydrogen is regulated by the presence of the vanadic acid, since this passes into hypovanadic acid, and is immediately again oxidised to vanadic acid by the hydrochloric acid, while the hydrochloric acid liberates an equivalent of chlorine and four equivalents of oxygen. An addition of ten per cent. of bichromate of potash to the acidified solution increases the output. Special cells have been designed for application to motor cars.

Model Yachting Supplement.

Model Yacht Measurement Rules.

By CHAS. E. HANCOCK.

BEFORE entering into the merits, or otherwise, of the various rules which have at some time or other been tried in different clubs, it may be as well to see what varieties of boats there are to cater for; and in doing this we shall be able to account for the preference some owners have for some particular rule.

The classes of models may be very fairly divided as follows:

The old big displacement type. This type sailed in a class which was measured by length over all. These classes were usually 3 ft. 6 ins. (sometimes 3 ft.) to 5 ft. and over. They were big, heavy boats, carrying enormous sails, on which there was no tax, and the man with the biggest boat for her length over all often had the best chance. The beam of these boats often reached 14 or 15 ins. for 4 ft. of length, and the displacement in such cases perhaps some 60 or 70 lb. The outcome was the tax on beam of the

1730 Rule. Under this rule the boats began to grow in length but got very little lighter in displacement. There was still no tax on sail, neither was there any restriction in the matter of weight. The 1730 rule was a step in the right direction, but it taxed beam most unreasonably, as the result clearly showed. Under this rule some boats were built as narrow as 1 of beam to 8 of length on l.w.l.

The clubs soon began to cast about for something better, but the 1730 rule had certainly a long innings. In 1893 and 1894 numbers of propositions were made, some of them fairly good. Many, however, complained because, under the tonnage rules proposed, light displacement craft worked out equal in tonnage with boats of twice the weight and more, overlooking the fact that the tonnage arrived under the proposed rules was "sail tons," and not displacement tonnage, or anything supposed to resemble it. The consequence was that the discussions bore no fruitful result, and model yachtsmen fell back upon the L. & S.A. rule adopted by the Yacht Racing Association. This august body, foreseeing the difficulty, perhaps, of reconciling any tonnage measurement with the light displacements of the vessels which were wanted by designers, adopted a rule under which the tax on beam and draft was practically completely removed. They, however, introduced a limit to the sail area, awarding certain amount of sail to certain water line lengths to suit various rating classes. In some cases the rating came out at—I was almost going to say—minus quantities, for boats of really comparatively large size as far as speed and sail area went. Various classes were provided, so that model yachtsmen had a large choice. The 10-rating class was perhaps the most popular, and was much built to. The great value of the untaxed beam and draft, coupled with light displacement, was soon discovered, and a study of the models would lead one to think that in most instances the designing, as far as the lines of the craft were concerned, was a matter of secondary importance. Certainly the great value of a bow overhang was

only properly appreciated when these canoes came into vogue. Previously our straight stem boats often sailed bows under carrying as much head sail as after sail. We began to cure that. The striving after extreme proportions of beam and unwholesomeness generally struck the "august body," and it was seen that a new rule must be adopted to check the development of a really very unsafe type.

The outcome was the present Linear Rating Rule. This was introduced to encourage the production of a boat with more "body." Whether it has done so, I will not venture to say. It is evident, I think, that the avoidance of any expression of "tonnage" has been adhered to for the same reason as caused it to stand aside when the L. and S.A. Rule was adopted. On the Continent some measurement of "sail tons" has, I believe, been adopted, but I cannot call the formula to mind at the moment. Some of the formulae are formidable. The linear rating rule has not, I think, been tried at all by model yachtsmen, probably on account of its complicated character. It consists of a tax on beam and length on water line, combined with a penalty on sail area, and the under water girth measurement of the hull. This girth measurement is supposed to introduce an additional tax on beam as well as to a certain extent taxing the draft and general stability of the boat. Under the rule time allowance is awarded to the smaller vessels, but I am not aware that the allowance bears any relation to the length of time a race may occupy. At all events, with the exception of the largest class, the boats which have been built under this rule have been very nearly alike in every respect. There has been no departure from a kind of stereotyped pattern. Perhaps we have reached the limit of possibilities in the direction of improvement. I take it, however, that the sport of yacht racing should permit, under the rules which govern it, of some latitude in the matter of choice of design. It must be acknowledged, however, that under the linear rating rule some very handsome and yachtlike vessels have been built, even if there is in the smaller boats rather a restricted space at command inside. I suppose that racing yachts will never be cruisers, but there seems no reason why cruisers should not make first-class racing yachts. As it is, a racing yacht pure and simple is no good for anything else, and this in spite of the example set by *Britannia*, H.R.H. the Prince of Wales, a boat with a grand record, built originally as a fast cruiser.

It is only because model yachtsmen are, after all, guided by what goes on in the world of real vessels that the foregoing has been so largely entered into. One outcome of the uselessness which threatens a boat built under the linear rating rule after a year or two is that a departure has been made in the direction of one design classes. Such an arrangement as this will probably never commend itself to model yachtsmen. One of the most interesting features of the sport is the making and designing of the craft, and the study it involves. The advent of one design classes has, however, brought out the bigger bodied boat, a thing which was most wanted, but which no sail area or linear rating rule as adopted by the Y.R.A. could do. The only pity is that it is "one design." It produces sport, however, and sport is essentially English.

To sum up, then, it would appear that the best all-round rule is one of tonnage. Not displacement tonnage,

but "sail" tonnage. That this tonnage should not be ascertained by any measurement or restriction of sail, but by the dimensions of the hull. The advantages of such a rule would be the facility with which it could be applied to all existing vessels as well as future ones. It would not, perhaps, debar the extreme type, but would give a wholesome, all-round boat a good chance in ordinary weather. As it is at present, the light weather boat has considerably too much advantage. For model yachtsmen such a rule would provide sport for owners who had, and perhaps still have, their good old boats of years ago, but who left the sport in disgust when the rating rules—and the type of vessel they produced—came in. We have learned a good deal from the different rules. They have not been a bad thing for yachting; but I think the return to a decently roomy keel boat is only a matter of time in all the sizes.

The rule I would propose for the general acceptance of all model yachtsmen is the one we have adopted in our

The Inverleith Pond.

THROUGH the courtesy of Mr. Alexander Flockhart, we are enabled to reproduce the accompanying photograph of the east end of the Inverleith Pond which forms the sailing station of the Edinburgh and Leith M.Y.C. It will be noticed that three classes of boats are represented among those ready to start sailing, one boat of each class being identified by the figures 1, 2, 3 in the photograph. The measurement rule of this club was explained on page 119 in our June issue. The boats shown in this illustration took part in a race for Mr. Turner's special prize on June 24th, with the result that *Corina* (Mr. Bruce) was first; *Empress* (Mr. Kerr) second; and *Lapwing* (Mr. Nicolson) third. On July 8th *Alice* (Mr. Porteous) won the race for Mr. Millar's special prize, and Mr. Flockhart's *The Dean* won the race for Mr. John Marshall's special prize.



MODEL YACHTS AT THE INVERLEITH POND.

Roath Park Model Yacht Club:
$$\frac{L + (B + D \times 2)}{4} = \text{tons.}$$

This rule is now going through its fourth year's trial, and has given us great satisfaction, enabling us to compare models of all types, and to please any stranger who sails with us at any time, because he knows he is sailing us on our own terms, and that he can always get a race whenever he likes to turn up. We handicap the boats, giving 1 second per ton per minute we calculate the race to take. Our races generally occupy about 40 minutes over a course about $1\frac{1}{2}$ mile long. Under this rule, old 1730 tens work out at from 17 to 19 tons, and modern 20-raters, 23 to 25 tons. An average 10 rater will come out at about 20 tons. These are "sail tons."

Several readers having pointed out that the sail area of the model 10-rater cutter yacht described by Mr. G. R. Scott in a recent issue, was too great, that gentleman writes stating that the sail plan was merely an illustration of the style of rig required. Mr. Scott intended to give the dimensions of each sail as follows: mainsail, 880 sq. ins.; gaff, 160 sq. ins.; foresail, 210 sq. ins.; jib, 250 sq. ins.

The "Shamrock" and the "Columbia."

IN view of the widespread interest taken in the forthcoming contest for the American Cup, we append the following details of the competing boats, the *Shamrock* and *Columbia*. We are unable to vouch for the strict accuracy of the figures given; but as they have already appeared in several important newspapers, we believe they are reliable, though in some instances we have noticed discrepancies in the accounts published. We give outline drawings of the hulls of the respective vessels, which will enable a comparison of their lines to be made.

According to an account in a recent issue of the *Golden Penny*, the chief dimensions of the *Shamrock* are: Length on load water line, 89 ft. 6 ins.; length over all, 132 ft.; beam, 24 ft. 4 ins.; draught, 20 ft.; forward overhang, 20 ft.; after overhang, 22 ft.; tons of lead in keel, 80; displacement, 144.3 tons; freeboard at bow, 7 ft. 4 ins.; freeboard at stern, 5 ft.; freeboard amidships, 3 ft. 10 ins.; surface below water, 2,610 sq. ft.; working sail area, 12,315 sq. ft.; height of mast from deck to hounds, 77 ft.; distance from deck to topmast, 123 ft.; greatest circum-

ference of mast, 60 ins.; length of boom, 105 ft.; length of gaff, 65 ft.

The details of her sail plan show that her mainsail will be 7,670 sq. ft.; staysail, 1,760 sq. ft.; jib, 1,650 sq. ft.; topsail, 1,235 sq. ft.; making a total working sail area of 12,315 sq. ft. The spinnaker will be 7000 sq. ft., the jib topsail 1,620 sq. ft.; making a grand total of 20,935 sq. ft.

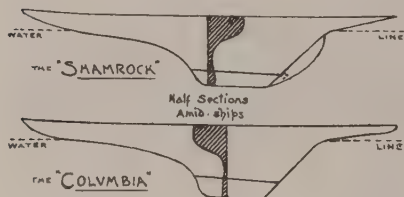
The 80 tons of lead which form the keel of the *Shamrock* were poured into a mould surrounding the skeleton keel, and became fixed by ribs projecting from the sides of this skeleton. This method was an improvement on the old way of riveting the lead on to the keel. The keel has a bulging form, rounded at the bottom.

In another paper, the *Scientific American*, we find the sail area of the *Shamrock* put down as 14,125 sq. ft.; the displacement as 147 tons; the length over all 132 ft. 2 ins.; and the beam 24 ft. 6 ins.; the other figures agreeing with those quoted above.

The figures for the *Columbia* are given in the *Daily News* as follows:—Length over all, 131 ft. 4 ins.; length on load water-line, 69 ft. 10 ins.; beam, 24 ft. 2½ ins.; draught, 20 ft.; displacement, 149½ tons; sail area, 13,940 ft.

In the *Golden Penny* the *Columbia* is described as follows:

The *Columbia*, according to her plans, has a length



DRAWINGS SHOWING THE OUTLINE OF THE HULL OF EACH VESSEL.

over all of 131 ft. 4 ins., 8 ins. less than the *Shamrock*. The *Columbia* has 24 ft. 2½ in. extreme beam, 1½ in. less than the *Shamrock*. The *Columbia* draws 20 ft. 3 ins., which is 3 ins. more than her rival. She has 90 tons of lead in her keel, 10 tons more than the *Shamrock*. Her displacement in tons is 145, against 144½ of the *Shamrock*.

The *Columbia's* free board at the bow is 2 ins. more than the *Shamrock*, at the stern 3 ins. less, and amidship 2 ins. more. The *Columbia* has a surface below water of 2,670 sq. ft., against 2,610 sq. ft. for the *Shamrock*.

The *Columbia* will have a mainsail of 7,475 sq. ft., staysail 1,600 sq. ft., jib 1,850 sq. ft., topsail 1,400 sq. ft.; making a total of 12,325 sq. ft. of working sail, against 12,315 sq. ft. for the *Shamrock*.

By making the *Columbia* finer and flatter in the floor than the *Defender*, Herreshoff aims to make her faster with the wind abeam. The *Columbia* exceeds the *Shamrock's* 20 ft. of draught by 3 ins., which should make the American boat faster going to windward. The form of the *Columbia's* keel, which has flat sides, as compared with rounded sides in the *Shamrock*, will make her hold the water better and is considered a distinct advance by Herreshoff.

The plates of the *Columbia* are of Tobin bronze, which is nearly the same as the manganese bronze used in the *Shamrock*. The metal has the merit of not corroding in sea water.

Correspondence.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication. Communications should be written on one side of the paper only.]

Model Yacht Measurement.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I think "Sail Tons" might have given his name to support his criticism; it would have added more weight to the same. The criticism may be fair, but it doesn't appear to me to be so.

In the first instance, he is not satisfied with Mr. Watson's detail of the Plymouth Club rules, because he hasn't given himself away as he says Mr. Ritchie has. Probably, had Mr. Watson given any definite dimensions, "Sail Tons" would have decided it was superfluous, and could have been "filled in" by readers, as he states with regard to the Dundee measurements.

He favours "O. B.'s" measurement rules, and speaks of the 1730 Rule. This infers that he has an interest in 1730 measurement rules. If so, perhaps he will give us his views in support of the same. For myself, I am of opinion that there is as much between the 6000 and 1730 Rules for models as there was in these rules for large yachts.

As "Sail Tons" also has a fault to find with Mr. Flockhart, with reference to the depth of models, probably he would like to know that I, for one, filled that little detail in for myself, and concluded that the Edinburgh and Leith Club sail in a pond, and the draft of models is controlled by depth of pond. Perhaps I am wrong; but I know the pond in some places has the effect of governing draft of models.

Although I am removed from Plymouth, I can assure "Sail Tons" that if he will apply to the secretary, or any members of the club, in sufficient time, on any occasion he may be in the vicinity of their club, he will find that their Club Room on West Hoe Pier is at his disposal for storage of model, and he can be accommodated with racing on any Saturday afternoon from 3 p.m., the racing being for 5-, 10-, and 20-raters on alternate Saturdays.

Probably Messrs. Watson, Flockhart, and Ritchie may have something to say in reply to "Sail Tons," and if so, I hope they will excuse me for anything I may have said herein.—I am, Sir, yours faithfully,

WILLIAM CUBBIN, P.P.M.Y.C.

Queenstown.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Having received your issue for June on the 22nd, I am unable to forward this sooner. Though not desirous of entering your competition, I append some ideas gleaned from racing a model under various rules, in case they may be of interest. Also a formula, which I believe good, and which certainly is simple.

1730 Rule.—This has been misunderstood by designers, who have been led by the heavy tax on beam to produce long narrow boats of large displacement and sail area. Boats of moderate beam, less length and displacement, with fin keels, are good under this rule in strong breezes, and compare more favourably under other rules with craft built to them.

L.W.L.—This rule produces craft of large displacement and sail area. Under it its children are successful

in light and moderate breezes against boats built to sail area rules, but are not good against them or the 1730 Rule boats under their own rules.

Weight.—This rule produces craft of large dimensions, varying considerably as to length and beam; enables a suitable craft to be built to the conditions of any particular locality under its own rule, probably best in its own place. Probably the children would rate too large under other rules for successful competition.

L. and S.A.—Under this rule its children are better 6000 than 1730 or L.W.L. boats, and in strong breezes better than those under their own rules.

Linear Rating.—Under its own rule better than 1730 and L.W.L.; slightly better than L. and S.A. boats. Under their own rules better than 1730 and L.W.L. boats in good breezes, and slightly inferior to L. and S.A.

My theory for measuring racing craft is that all dimensions assisting speed should be taxed. *Length* gives a possibility of attaining a certain speed. *Sail area* gives the power of attaining speed due to length. *Depth* gives weathering qualities, and by enabling ballast to be placed low, in conjunction with *beam*, gives power of carrying sail and maintaining speed.

Proposed formula.
$$\frac{L + B + D + \sqrt{SA}}{3} = \text{Rating.}$$

L = length over all. My reasons for not using L.W.L. are difficulty of measurement; re-measurement required on altering ballast; difference of length in fresh and salt water, and lengthening of water-line when heavy rudders are used. Many are against taxing overhangs; but, if of use, why not tax them, and, if of no use, why have them?

B = extreme beam wherever found.

D = depth from covering to bottom of keel. Depth below water is open to some objections as L.W.L., and folk will not build craft with more or less freeboard than necessary.

SA = sail area measured in usual manner; its square root is taken to make all the factors linear.

As the power of carrying sail is affected by B and D, this item might be neglected, and the formula would then be:

$$\frac{L + B + D}{2} = \text{Rating.}$$

—Yours faithfully,

OWEN F. GILLET, T,

Commander "H.M.S. Crescent,"

North American Station, June 24th, 1899.

"Best Design for a Model Sailing Yacht."

TO THE EDITOR OF *The Model Engineer*.

SIR,—As to the class of design for the competition proposed in the June number of *THE MODEL ENGINEER*, it goes without saying almost that it should be that of a racing yacht, and that a maximum of speed and stiffness will be the main consideration. Most racing yachts are cutters, and this rig is probably the favourite with the majority of model yachtsmen, but, personally, I would suggest offering a prize for the best design for a model schooner (racing), which beautiful rig is to my mind unduly neglected. I suggest a boat 36 ins. or 40 ins. on the water-line, with fin or bulb-fin keel.

Speaking of two-stickers, I saw last year on Lowestoft Model Yacht Pond some very fast models of "Beach Yawls"—really a long bodied two-masted lugger—which held their own very well against the cutters, keeping straight on their course and not dodging about with every puff like the shorter bodied boats. It would be interesting if some Lowestoft correspondent could give details of these vessels.—Yours very truly,

Old Charlton, S.E.

"GOELETTE."

Racing Reports.

The East Coast Model Yacht Challenge

Shield.—The race for the East Coast Model Yacht Challenge Shield was sailed on the Kingston Club lake, Inglemire Lane, in a strong south east buffeting breeze. The boats entered were the *Annie*, *Whiff*, *Edith*, *Esperanza*, *Wasp*, *Ida*, *Glance*, *Falcon*, *Jock*, *Fanny*, and *Minerva*. The first pair crossed the line about 3.50, and after a good race the *Annie* won. A great deal of care had to be used in getting the boats to lay the course, as the wind shifted about so much. The boats working the best to windward stood the best chance of winning. The boats showing the best qualities were the *Falcon*, *St. George*, *Annie*, *Esperanza*, and *Glance*. The contest was very keen, but the *Falcon* and *St. George* were well sailed, and the smart little *Falcon* beat the old Hull champion. After three hours' hard sailing all heats were got through, and in counting up the log Mr. Barne's *Falcon* (Hull) took the first prize and shield; Mr. Welsh's *St. George* second; and Mr. Mill's *Annie* (Kingston) and Mr. Butter's *Esperanza* tied for third. In sailing off, the *Annie* won. Mr. Bruce and Mr. B. Bell acted as judges, and their ruling gave great satisfaction. Mr. Bruce presented the prizes and complimented the winners.

Guernsey M.Y.C.—The racing season of this club was opened under the presence and patronage of His Excellency Major-General Saward. The direction was under Major Bernard, commodore; and T. De Saumarez, vice-commodore, and there was a large attendance of spectators. The weather for the competitors was good, a keen N.E. wind blowing, and the sailing was remarkably fast. We understand that at the end of the season a championship medal is to be awarded to the boat obtaining the largest number of points. The following is the result of matches:—No. 1 race—1, *fill*, C. A. Renouf; 2, *Flatfish*, James Besnard. No. 2 race—did not fill. No. 3 race—1, *Fern*, J. Norman; 2, *Elsie*, Ira C. Ozanne. No. 4 race—1, *Flying Spray*, Ira C. Ozanne; 2, *Olive*, G. Lihou. No. 5 race—1, *fill*, C. A. Renouf; 2, *Flying Spray*, Ira C. Ozanne; 3, *Eclipse*, I. Ozanne.

On the occasion of the fifth Newcastle Lifeboat Saturday Movement demonstration a 15-rating model yacht race for yachts of the district, which was sailed on the Town Moor lake, the Newcastle M.Y.C.'s headquarters. Three prizes of 25s., 15s., and 5s. value were offered, but only a poor response was made by the neighbouring clubs—only one entrant, Mr. H. Sharp, hon. secretary of the Tyne-mouth Club, having sufficient courage to meet the celebrated Newcastle 15 raters on their own pond. The fleet consisted of nine home models with Mr. Sharp's *Aurora*. A full tournament was sailed, and resulted in the *Aurora* tying with J. Steven's *Lucrific*, for first prize, each of these yachts with seven wins, two losses, having sailed very steady on the beam. In the final *Aurora* kept the best course, and sailed home a winner by two lengths. The winning yacht, which was launched this season, is 50 in. L.W.L., 7½ in. beam, sailing in the 15-ton class, and is somewhat crippled for sail in a rating race, though she sails well under the smaller canvas, even in a light wind. She is well cut away forward and has a long cut away aft, with no rudder post, fish-fashion, and two fins with little over 13 lb. of lead. The second and third yachts are of entirely different type, built especially under the racing rule with about 43 in. to 45 in. L.W.L., and 10-in. to 13-in. beam, and have both proved themselves capable yachts in club and inter-club racing.

Design for a 100-Watt Dynamo.

By E. L. PEARCE.

IN this machine the field-magnet should be of soft cast-iron, and is made in two parts, the joint being in the centre of the core. One pattern only need be prepared, as shown at top in Fig. 1. This will be for the upper portion of the field-magnet, and a casting should be

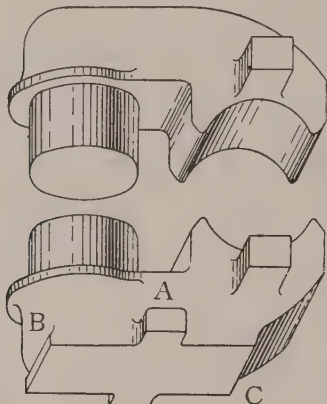


FIG. 1.—THE PATTERNS FOR FIELD-MAGNETS.

obtained. Then the pattern can have the holding down lugs at A (Fig. 1), and the corners filled in at B and C for the lower part.

To make the joint in centre of core, bolt the top pole piece (with its core projecting outwards) to the faceplate

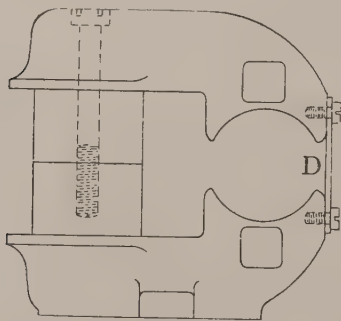


FIG. 2.—THE FIELD-MAGNETS FITTED TOGETHER.

of the lathe, and set the core so as to run true. Then take a cut across face and drill a clearing hole for screw. The bottom pole piece should have a tapping hole for screw about 1 in. deep. When the two parts are screwed together, fix the brass plate to front of pole pieces as shown at D (Fig. 2) with four screws, before boring out pole pieces. The clearance between armature and poles should be about 1-20th in. The bearings should be cast in gunmetal or brass. The shaft should be of mild steel, and the armature discs of soft sheet-iron.

The following are the windings recommended:—For 10 to 12 volts and 8 to 10 amperes wind armature with No. 20 single cotton covered wire ten turns per slot—about ½ lb. Field-magnet should be wound with 3 lb. No. 21 s.c.c. copper wire for a shunt machine. If com-

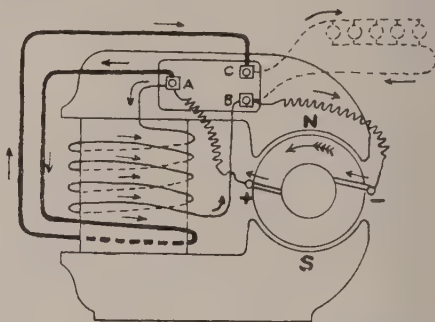


FIG. 3.—DIAGRAM OF COMPOUND WINDING.

The Shunt Coil is shown by thin lines. The Series Coil is shown by thick black line. In the Simple Shunt, Winding Terminus C and the Series Coil is omitted.

pound winding is required, put on 2¼ lb. No. 22, and 1 lb. No. 14, about fifty turns. For 20 to 25 volts and 3 or 4 amperes, wind armature twenty turns No. 24 s.c.c. in each section; fields, 3 lb. No. 24.

The speed of the dynamo should be about 2,400 revolu-

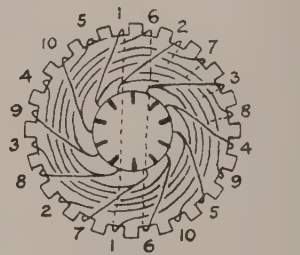


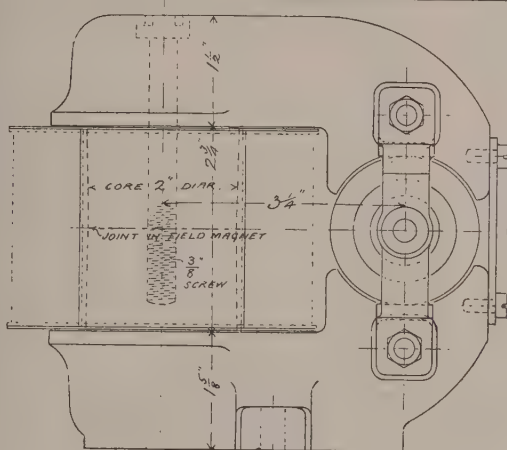
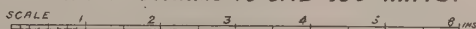
FIG. 4.—DIAGRAM OF ARMATURE WINDING AND CONNECTIONS.

First Coil is wound in slots	1 and 1.
Second	11 and 6 and 6.
Third	11 and 2 and 2.
Fourth	11 and 7 and 7.

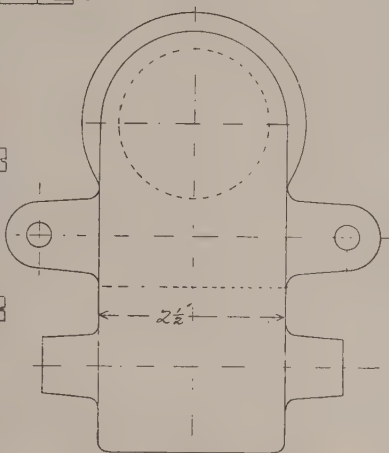
tions per minute. I might, perhaps, state that though it will be possible to get 100 watts out of this machine, its ordinary working output should be regarded as about 75 watts.

The engineering department of the new White Star liner *Oceanic* will have a staff of 182 men, including 22 engineers—about 39 more hands than are on the *Majestic*. The crew, all told, will number about 350. The chief engineer will be Mr. T. Wilson Sewell of the *Majestic*, belonging to the same company. The *Oceanic* is the largest merchant vessel in the world.

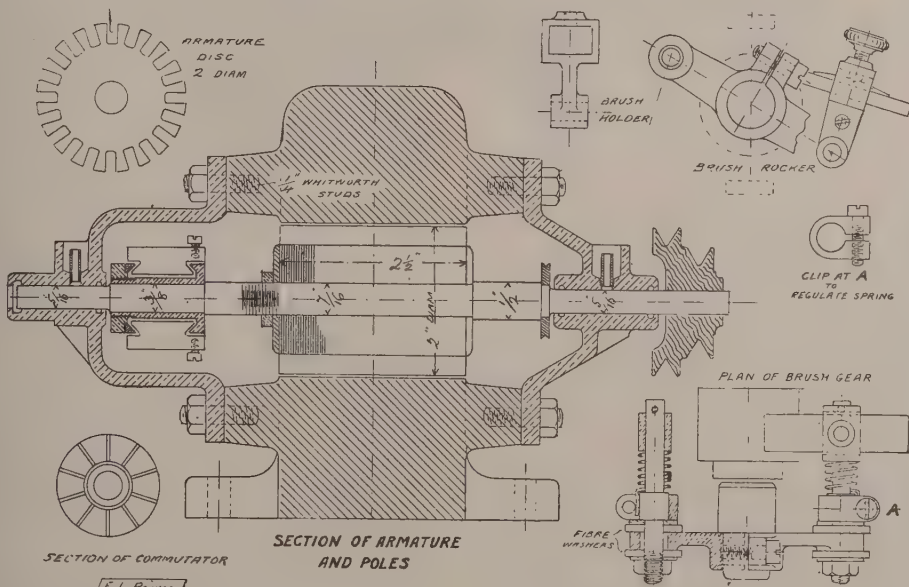
DETAILS OF DYNAMO TO GIVE 100 WATTS.



ELEVATION OF DYNAMO.



PLAN OF FIELD MAGNET.



SECTION OF ARMATURE AND POLES

PLAN OF BRUSH GEAR

SECTION OF COMMUTATOR

L L Pearce

Our Beginners' Column.

How to Start a Workshop.

By "ATLAS."

THERE are, no doubt, many readers of this paper who have gazed with longing eyes on the illustrations of model locomotives, dynamos, and other pieces of mechanical and electrical work which have from time to time been illustrated in these pages, but who, for lack of a workshop, have not yet attempted to carry out any constructional work of their own. The following notes have been written for those who feel they would like to try their hand at making something, and who are in want of advice as to the best sort of tools and equipment to procure.

There are two considerations which must exercise a great influence over the plan to be adopted in starting a workshop; firstly, the class of work which the reader intends to take up; and, secondly, the amount of money he is prepared to spend on the necessary tools and appliances. It is quite a mistake to imagine that but little in the model way can be accomplished without an elaborately equipped workshop. It is not so much the tools which are employed as the skill and ingenuity of the individual who uses them, which enables good and substantial work to be performed. While I do not advocate

have no doubt the Editor has some other articles on the same subject in store.

The tools which I am about to describe will enable the reader to undertake a considerable amount of electrical apparatus-making, in which lathe work is not so prominent a feature as it is in model engine and dynamo construction; but the reader will also be enabled by their use to make many parts of a model engine, and even to complete one, if he gets his turned work done by one of the numerous firms of model makers who advertise in this journal.

THE WORKSHOP.

Before discussing the equipment of the workshop, it is necessary to choose the workshop itself. This may be either indoors or outdoors, but it is highly desirable that it should be both dry and well lighted. The reader will be wise if he secures a room, or a corner of a room, where he can at any time leave his work and his tools without the necessity of packing them away. The majority of amateurs have only a limited amount of spare time to devote to their hobby, and if the reader has to get out his tools and arrange the work and bench afresh each time, and to replace everything when the evening's work is done, a lot of valuable time is wasted.

THE BENCH.

The first workshop appliance is, naturally, the bench, and this should be of a very rigid character. An old

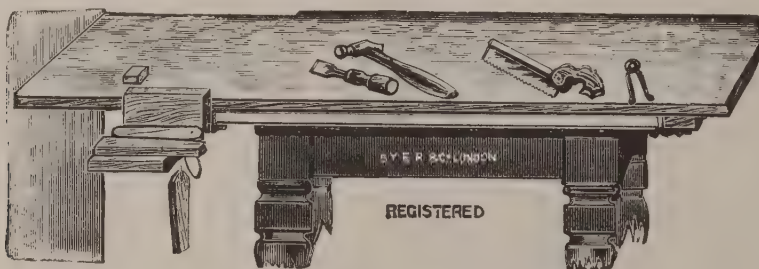


FIG. 1.—SIMPLE BENCH, TO FIT ON TO ANY ORDINARY TABLE.

too much of the "pocket-knife and bradawl" class of work, yet I feel sure it is a good thing for the young model-maker to commence work with comparatively few tools. Under such conditions he is forced to think for himself how to carry out the given task with, perhaps, scanty and ill-adapted appliances; but then the very necessity for thought trains his inventive faculties, and at the same time is more likely to make him a thorough master of the few tools which he possesses. I propose, therefore, to confine myself to suggest only such tools as are really necessary for the beginner to acquire. As he grows more experienced, and undertakes more important work, he can add such other appliances as he may feel justified in purchasing.

Undoubtedly the most useful and most important tool for the amateur model maker is the lathe; but, unfortunately, this is at the same time the most expensive, and it is by no means every young engineer who can find the wherewithal to purchase a serviceable tool. I will, therefore, leave the consideration of the lathe to a later portion of my article, and will commence by dealing with the selection of hand tools. As a matter of fact, it is not a very difficult thing for anyone with some little mechanical skill and a few plain tools to make his own lathe, and some descriptions of simple home-made lathes have already been published in THE MODEL ENGINEER. I

kitchen table makes an excellent work bench; or if the reader has any carpentering skill, he may, without much difficulty, construct his own. The essential points are that the framework of the bench should be very firm, and that the top should be of thick wood so as to be capable of supporting occasionally heavy castings, and to stand the jar of any hammering, &c. The boards forming the top of the bench should fit very closely together, as, otherwise, frequent annoyance will occur through pins, screws, and other small articles falling through the cracks and getting lost. The bench should be, preferably, placed against the wall, immediately in front of the window, where a good strong light can be obtained, and if it is permissible to make a permanent fixture of the bench or work-table, it should be fastened to the floor and wall by small iron angle brackets. If one or two drawers are fitted to hold files, chisels, and other similar tools, it will be found a convenience. A tool rack should also be fitted along the back of the bench, in which various hand tools may be placed so as to be ready for use when wanted. Tools with keen cutting edges should never be allowed to lie about on the bench when not in use, as they will assuredly get damaged. Have a rack to hold such tools, and keep the tools in the rack. It is difficult to give a suitable height for the bench, as this must largely depend on the stature of the individual who

is going to work there; but the usual rule is that the jaws of the vice which is to be placed on the bench should be about level with the worker's elbow. If the reader already has a table which he proposes to turn into a bench, and which may not quite conform to the rule, the vice, of course, may be easily raised by placing a piece of hard wood underneath it before bolting it down to the bench. If, on the other hand, the bench is already too high, the simple expedient of cutting a short piece off each leg will bring the desired result about. A suitable size for an amateur's bench is 5 ft. long by 3 ft. high by about 20 ins. wide. The bench shown in Fig. 1 is a useful kind for the beginner, as besides being very inexpensive it can be readily fixed to any ordinary domestic table without injury to the latter. It is made by Messrs. T. J. Syer & Co., 45, Wilson Street, Finsbury, and is fully described in their catalogue.

THE VICE.

Having obtained the bench, the next thing is to fix a suitable vice thereon. There are many patterns of engineers' vices on the market, and probably the amateur may feel rather puzzled as to which type to select. I would recommend him to get one with parallel steel jaws (as illustrated in Fig. 2) to bolt to the top of the bench. A useful size is one with about 3 or 3½-in. jaws opening to about 4 ins. If the

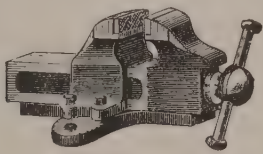


FIG. 2.—PARALLEL VICE.

vice is fitted, as many of them are, with a small anvil at the tail end, this will be found very useful. The best position for the vice is about 12 ins. from one end of the bench, as this leaves a considerable portion of the bench surface clear for erecting or putting the parts of the model together. It is important that the vice should be directly in front of a window where the best possible light can be obtained, and for evening work there should be either a gas jet or lamp bracket close by. The vice should be very firmly screwed to the bench, perhaps the best way being to fasten it down by bolts going right through the top of the bench.

(To be continued.)

Electrical Experiments Without Apparatus.

FEW people—even amongst advanced students of electrical science—know the amount of interest and instructive amusement to be got out of the homeliest materials for the production of electrical energy. It is safe to say that the amateur who spends a few hours in trying the following experiments, especially if he follows them up by investigating the properties of other materials at hand, will gain no little insight into the ways of the “mysterious force.” At the same time he will have spent a very enjoyable time, hardly less enjoyable indeed, than in the building of dynamos (which sometimes *won't* work) or making telephones (which often *won't* speak). A sheet of brown paper will generally prove amenable to persuasion in the matter of giving sparks, when a $\text{£}20$ Wimshurst is taxing all the operator's powers of speech!

First get your brown paper. Don't be put off with an old piece which has been creased in all directions; use a nice new piece of stiff, thick paper, and cut it to a size of

about 12 ins. by 9 ins. Cut off each corner about $\frac{3}{4}$ in. Undoubtedly, the best place to perform these—or, in fact, any experiments with “frictional” electricity—is before a good hot fire. At the time of writing the thermometer stands at about 85° F. in the shade, and to talk of a good hot fire—! A certain degree of darkness is necessary if the effects are to be well observed. The only other requisites are a clothes-brush, some scraps of paper, and other objects which surround one in an ordinary household.

If the fire be forthcoming, hold the sheet of brown paper before it for some seconds, grasping the paper by one of the ends in the left hand. Now seat yourself and draw the paper rapidly two or three times over the right leg, holding the right arm flat down on it so that the sheet of paper gets rubbed for its whole length and breadth by two woollen rubbers, namely, the coat sleeve and trousers leg. In some states of the weather, and sometimes when the right sort of paper has been hit upon, the above process will render the sheet of paper so electrically active that it will become a positive trouble to get it away from the sleeve or leg. Still holding the sheet by the left hand, allow the fingers of the right to approach it, when, if all has gone well, a stream of sparks will pass between the paper and your fingers wherever these are allowed to approach. The supply of electrical energy is rapidly dissipated, so that you will be kept pretty busy rubbing the brown paper. It may be mentioned that these sparks, though long and bright, are perfectly harmless; they often make a crackling noise, but it is generally not possible to feel any effect upon the hand.

Again rubbing the sheet of brown paper as before, hold it by both ends, and pass it up and down the face, keeping a slight space, say half an inch, so that the paper is not actually touching. The stream of sparks will take place, but the electrical action will in this case be *felt*, the effect being as though hundreds of cobwebs were being drawn about the face. Only the young and enthusiastic electrician will thoroughly enjoy the sensation!

Give another rub to the paper, and holding it as before in both hands, move it about at a little distance above somebody's head. Experiment, if possible, on someone whose hair is of the light and fluffy order, and you will be delighted to see it “stand on end” in very realistic fashion, following every movement you make with the paper. If you have not already, in your attempts to get near the fire, trodden on the tail of the domestic cat, you might next press her into the service of science, when you will probably find her fur to be exceedingly suitable for the purposes of this experiment. Cats, however, rapidly become tired of real scientific investigation.

The rubbed paper will show all the usual experiments with pith-balls, attraction and repulsion, the electroscope, and so on. It is, indeed, a most useful generator of electricity, and the amateur will find it a good substitute for the usual glass rod. If he possess an electroscope, experiments to show the nature of the charge produced will also be found instructive, while the common laws of attraction may be shown in the following manner. Tear up a piece of white paper into portions somewhere about $\frac{1}{2}$ in. or $\frac{3}{4}$ in. square. Excite the brown paper by rubbing as usual, and hold it vertically in the air. If now a few of the pieces of torn paper be taken in the other hand, and released when some three or four inches away from the hanging sheet, the attraction will be so great that all the little white scraps will at once fly to and adhere to the brown paper. Remaining there for a few seconds, they become charged with electricity of the same nature as that on the large sheet, and are then suddenly repelled, being shot several inches away. Again, if the sheet be

once more excited, and allowed to approach the wall, the undersides of a shelf, or other similar place, the brown paper will at once fly to it, and stick there for some considerable time.

The above are merely hints. Every amateur worth his salt will want to carry such experiments much further. Let him, therefore, take the clothes brush, and vigorously scrub his brown paper on the table. It will probably require an effort to move the paper, so closely does it adhere to the table top. Experiments may also be made in the matter of using rubbers of silk, wash-leather, etc., but it is important to remember that the best results are got when everything is dry and warm.

The Editor's Page.

WE are sorry that most of the readers who entered for our Competition No. 7 rather missed the object we had in mind when offering the prizes.

We wanted really to get descriptions of what we might perhaps term "show" models, instead of useful models; but the majority of the competitors have sent in drawings of small machines and tools which are intended for doing actual work, and which are models only in the sense that they are small in size, and not by way of being scale or approximate scale reproductions of the full grown article. After due consideration, we have decided to award the prizes to

Mr. William H. Buck,
Horsham, Sussex,

for his description of a model single-barrel force pump, and to

Mr. Harry Robins,
5, North-Western Terrace,
Victoria Road, Stafford,

for his description of a model drilling machine. A cheque of £1 is. has been forwarded to each of the above named. Mr. Wilfred S. Williams (Landore, R.S.O.) deserves special commendation for his excellent drawings of an accumulator pump, while other praiseworthy competitions were received from Mr. Arthur Cole (Barrow-in Furness), Mr. Harold Slicer (Bradford), and Mr. J. W. Wallis (Birmingham-on-Sea.)

We would take this opportunity of directing the attention of both present and future competitors to the fact that the drawings *must* be in good black ink, preferably Indian ink, on good white paper or clean cardboard. Pencil drawings, or those in weak thin ink, and scratchy lines are quite useless for reproduction purposes, as also are those in which any coloured lines or washes are used.

As promised, we commence in this issue the publication of some elementary articles suited to the requirements of our younger readers. By "younger readers" we mean not only those who are young in years, but also those who have reached a more mature age, but may still be youthful in point of engineering or electrical knowledge and skill. The subject of "How to Start a Workshop" should be of considerable interest to such readers, especi-

ally as we intend to combine with our suggestions on the choice of tools, some practical notes on the proper way in which the various appliances should be used. Workshop matters should appeal as strongly to electrical and mechanical readers; for the proper use of tools is as important in the construction and repair of electrical apparatus as it is in making engines and boilers.

While on this subject, we may draw attention to the article on soldering which appears in this issue. The instructions therein given are from the pen of an experienced professional worker, and should prove very helpful to those who wish to master this extremely useful process. We shall, in a future issue, give a second article by the same writer on the equally interesting subject of brazing.

With reference to elementary articles, we have received the following interesting letter from Mr. A. Caplatzi, who, as many of our readers know, is anything but a novice in scientific matters. We are pleased to find so expert and experienced a worker as our correspondent supporting our own views as to the need for good elementary instruction. He writes: "As regards a junior's page, I desire to say that it is a much-felt want, which you will do well to supply. No one can find fault with the excellent articles already appearing in your journal, but they are more suitable to adepts than to beginners; such adepts can find plenty of instruction elsewhere, whilst there exists very little good digestible construction for novices anywhere, and if you take it up you will accomplish a meritorious work, and find a large class of readers. Every advertiser will help you to recruit young would be engineers; for they thereby further their own interest as well. The majority of English boys play with mechanical toys in their infancy, and when they grow older they think, dream, and long for model machinery, which is their next step on the road that leads to engineering, which opened up the globe for British enterprise and greatness. Give us a page of simple articles, describe the necessary tools and materials, and the best way how to make them, and you will reap the thanks of the million."

We may point out to our younger readers that there is a good deal of elementary information and useful instruction on making simple apparatus and appliances, which appears each month in our "Practical Letters" column, and also in our "Replies to Queries."

The Institution of Junior Engineers have arranged a most enjoyable programme for their summer meeting this year, which will be held in the Portsmouth and Southampton district, and commences on August 11th. The visits include the Portsmouth Dockyard, Whale Island Gunnery School, Nelson's *Victory*, Portsmouth Electricity Works, the Southampton Docks, the works of the Liquid Fuel Engineering Company, and a trip round the Isle of Wight. Further particulars can be obtained from the secretary of the institution, Mr. Walter T. Dunn, 47, Fentiman Road, Clapham, S.W.

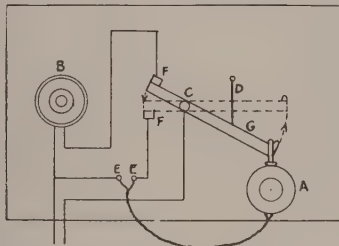
Practical Letters from Our Readers.

(The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.)

Automatic Telephone Switch.

TO THE EDITOR OF *The Model Engineer*

DEAR SIR,—Perhaps the following description of an automatic switch for a telephone may be of some use to your readers. B is an electric bell push, which, when pressed, rings a bell when the telephone is not in use, at the receiving station. When a person wishes to use the telephone, he presses the push B, and then by unhooking the telephone mouth-piece A, automatically switches off the bell and completes the telephone circuit. G is a metal lever acting on the pivot C, and pulled upwards by the piece of elastic D. FF are two blocks of metal.

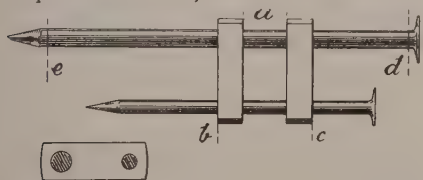


against which the end of the lever presses. When the telephone is unhooked, the lever springs up in the direction shown by the arrow heads, and remains in the position shown by the dotted lines. When the telephone is replaced, the weight of it pulls down the lever, and so switches the bell into circuit again. E E are terminals to which the flexible wire of the telephone is connected. This switch will be found very serviceable where a small telephone is used in conjunction with an ordinary electric bell circuit.—Yours truly,
H. W. P.
Bayswater.

A Simple Way to Make a Web Crank Shaft.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Some time ago I succeeded in turning out a very serviceable web crank shaft for model engine, which may be useful to amateurs. Select a long wire nail of required axle diameter, also a nail of half this thick-



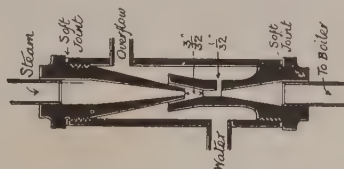
ness, and a piece of sheet brass of about 3-16ths in. thickness. File out of the brass two exactly similar cranks, and drill through each two holes, one for each nail. Now place them as per sketch, separating brasses as connecting rod requires, and solder brasses and nails together thoroughly with solder composed of one part silver, one part brass, using borax as flux. When this

has been done, file or saw out the piece of nail at *a*, and the ends of the other nail at *b* and *c*. Select good straight nails; drill holes in brasses to fit nails tightly; have parts to be soldered clean, and a very successful job can be done. An ordinary hot fire will do to solder.—Yours truly,
Dublin. C. R. L.

A Small Injector.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I enclose sketch of a small injector which may be of some use to your readers. It is made of brass tube and soft brass rod and is fitted with valves on steam



and water-supply pipes, the pipe to boiler having a ball valve. It should be made accurately, as injectors are rather tricky on a small scale.—Yours truly,
 Horsham. W. H. B.

Brass Foundry Work.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I have noted one or two items in regard to moulding in which I think I can assist some of your readers, if you think it admissible for a "trade" manager to do so.

Core and Dry-sand Venting.—Whether cores are used in brass or iron, they have to be vented, and with straight cores the ordinary method of passing a vent wire through is as good a plan as any, but with shaped cores proper wax venting material is desirable. Instead of using straws, wax tapers, and the like, use Gibb's "Wax Wire," which is supplied at 1s. 8d. per lb. by Geo. J. Gibbs & Co., Water Lane Works, Bradford. This can be bent in any form desired, and in drying the cores at a moderate heat the wax becomes absorbed in the sand, and leaves a clear air passage. *Never make cores red-hot, or they become rotten.*

Parting Sand.—This is either well-burnt black sand from the moulding floor, or crushed red sand brick (for brass), and can be easily made. The usual plan in a foundry is to mix a fair amount of coal dust with some ordinary used sand, and to throw this into the cupola after melting, or to fill an old crucible and place in one of the brass furnaces when the last crucible for the day is drawn. The sand becomes red hot, and gradually cools by morning, when it is taken out and sifted through a “30-mesh” sieve, and is at once fit for use. With the brick sand, a soft but well burnt sand brick is taken—Farnham “rubbers” are best—and crushed to pass through the fine sieve mentioned. If damp, the fine powder must be dried, otherwise it is ready for use. The smaller the percentage of alumina, the better the sand for parting, and *vice versa*. There is no sale for parting sand, as it is made in every foundry, and, therefore, it is useless to enquire where it can be obtained; and as there are so few amateur metal founders, the catering for this branch would not pay for advertising. I should not advise anyone to adopt Mr. Lionel Varicas’ advice as to walking into a foundry, unless he has the permission of the manager, because unpleasant things might happen. Besides, it is not honest to hinder men who are being paid £2 per week for their work.

Smooth Cores.—In the case of the ports in cylinders, and in other places where machining cannot be done with iron castings, the dried cores should be brushed over with ground charcoal and water and re-dried. With brass the cores may well be brushed over with whitening and water, or damped on the surface and well dusted with flour, re-drying to remove all dampness. This causes the cores to leave the casting with a smooth skin.

"Facing" Moulds.—Facing sand for iron is made of a mixture of old and new sand, with a proportion of ground coal, the proportions varying according to the class of work being dealt with, the whole being well mixed and passed through an "8-mesh" sieve. For brass, ordinary new sand finely sifted, Mansfield sand, or a mixture of sand and a small proportion of Bath brick, sifted through a "20-mesh" sieve, give a good face to the work, while for very fine work a little peameal may be mixed with the facing sand, and the mould dusted over with some wood ashes through a cloth.

Hot Cores.—Never put hot cores into greensand work, as they absorb the moisture and cause the work to be unsound, while there is also some danger from the steam causing the metal to "blow." Cores being, as a rule, surrounded with metal, must be *dry*, and in every case must be efficiently vented.

Melting Metals.—Metals or alloys which volatilise or oxidise readily should be melted in plumbago crucibles under a layer of ground charcoal, and should not be overheated or burnt, as with alloys this alters their composition very considerably. If metals are poured into a large head quickly they can be used at a lower temperature than if poured slowly into a small "runner," and if the moulds are properly vented to let off gases, they run very readily.

In conclusion, it may be well to point out that both brass and iron moulders have to serve a long apprenticeship, and that men of some age are often not "up" in all the intricacies of the work. Amateurs cannot, therefore, expect to learn how to mould and cast metals in a few hours, for, even when up in the theoretical part of the work, they have yet to attain manual dexterity, and the tools used are rather unhandy to manipulate at first.

London, W.

FE.

Proposed Feed Pump.

TO THE EDITOR OF *The Model Engineer*.

SIR,—With reference to the feed pump illustrated in your July issue, page 149, it would be impossible for a pump made as shown to work at all. The designer imagines that the sliding piston valve will only be moved by the steam piston, whereas he overlooks the difference in pressure on the top and bottom of its annular area, due to one side being exposed to steam pressure, while the other side has only the exhaust pressure to balance it, consequently the valve will follow the piston. This will close the exhaust port, and the pump will stop. I think a hand pump will prove to be the best method.—Yours truly,

H. P.

Heaton.

The following interesting facts, with regard to the London and North-Western Railway, were elicited during a recent visit of the Institution of Civil Engineers to the Crewe works. The company possesses a locomotive for every mile of railway worked by it. Two thousand nine hundred miles of line is owned by the concern, and the same number of engines is required to deal with the traffic. Twenty-one thousand persons are employed in the locomotive department—altogether the employees number 99,100 men—and every second of the day and night the engine mileage equals $2\frac{1}{2}$ miles, or enough to make a journey round the world every three hours.

Queries and Replies.

[*Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, FARRINGTON AVENUE, LONDON, E.C.6. The following are selected from the queries which have been replied to recently:—*

[1246] **Text-Book on Model Locomos.** W. A. M. (Penge) writes:—I thought about making a model loco, to burn coal or charcoal. Please could you recommend to me a text-book on the subject, as I think I should have a little difficulty with the firebox arrangement?

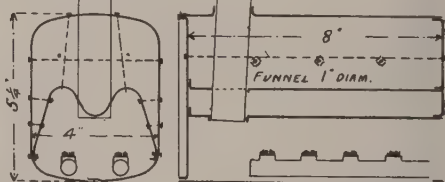
A very complete and practical work, which contains descriptions of several different types of locos, is "Model Engine Construction," by J. Alexander, 10s. 6d., or post free from our Book Dept., 6, Farringdon Avenue, E.C., 10s. 11d.

[1247] **Wireless Telegraphy.** R. H. (Jarrow) writes:—(1) Will you kindly inform me in what issues of THE MODEL ENGINEER, etc., the articles on wireless telegraphy appeared? (2) Can you supply me those numbers? (3) If not, is there any book treating the subject in a practical manner? Regretting that I have only become a regular subscriber to your excellent little paper during the current year.

(1) An article on wireless telegraphy appeared in the first number of THE MODEL ENGINEER. (2) This is now out of print, and can only be had by advertising or watching our Sale and Exchange column. (3) An excellent little book on the subject is "Wireless Telegraphy," by Richard Kerr, which can be obtained from our Book Dept., 6, Farringdon Avenue, London, E.C., post free, 1s. 6d.

[1248] **Boiler for Model Boat.** B. C. writes:—Kindly state dimensions of boiler, and engine suitable for driving a wooden boat, 3 ft. long, at about three miles an hour; also state beam and depth of same, and suitable wood also.

Boiler as per sketches below. Cylinder, $\frac{5}{8}$ in. bore $\times$ 1 in. stroke.



Material for boiler, copper No. 24. B.W.G., joints rivetted and carefully soldered. Pressure, 15 lb. on the square inch. Furnace, 1 in. diam. Make the boat $4\frac{1}{2}$ in. beam, 5 in. deep. If cut out of the solid, use a block of well-seasoned yellow pine, perfectly true and straight in grain, and without knots. A block of willow will also be a suitable material.

[1249] **Model Electric Cargo Boat.** E. S. B. (Church Stretton) writes:—It was a great pleasure to me to read Mr. S. L. Thompson's article on his Model Electric Cargo Boat in the June issue of THE MODEL ENGINEER. As my experience with electrical driven boats have so far been failures due to using too large a motor, and also using accumulators instead of primary batteries, I would be much obliged if Mr. S. L. Thompson would kindly inform me what size (capacity) his cell is, also what is the size of his motor, and where can a similar one be obtained.

Size of the cell outside over, $3\frac{1}{2}$ in. high $\times$ $3\frac{1}{2}$ in. diam., $\frac{1}{2}$ pint capacity. Size of motor over all, about $2\frac{1}{2}$ in. high $\times$ 2 in. broad, $\times$ $2\frac{1}{2}$ in. over bearings and thrust disc. No. 1 size motor castings from the British Modelling and Electrical Company, Macclesfield, would be made to make this motor.

[1253] **Cells over $\frac{1}{2}$ -in. Spark Coil.** G. B. (Haverstock Hill) writes:—How many pint bichromate cells must be used for induction coil recently made to give $\frac{1}{2}$ -in. spark; gauge of secondary wire, No. 38? Have experimented with four, but it is not efficient.

Three pint bichromate cells should be sufficient to work a $\frac{1}{2}$ -in. spark coil, if this is in good order. Presuming the proportions of the coil are correct, and quantities of wire sufficient, if you cannot get a satisfactory spark there is probably something wrong with the winding or connections. Perhaps we could advise further, if you supplied more particulars.

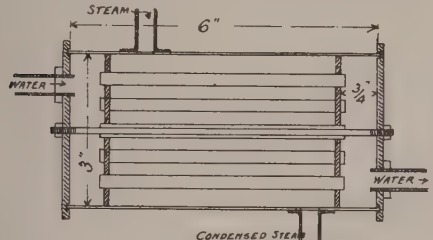
[1257] **Motor for Boat.** G. A. T. (Stoke Newington) writes:—Could you kindly inform me what sized boat a $\frac{1}{2}$ -h.p. motor could drive at about 5 or 6 miles per hour?

A boat 6 ft. to 7 ft. long, and 9 in. to 10 in. beam, would be the

largest size the $\frac{1}{2}$ h.p. motor would drive at 5 or 6 miles per hour, and it is likely that weight of motor, &c., would be enough to load such a boat too heavily. Such a speed is difficult to get, or rather to maintain for any length of time.

[1254] **Condenser for Model Launch Engine.** C. H. E. (Buxton) writes:—Could you give me a little sketch of a model condenser suitable for a double cylinder slide valve $\frac{1}{2}$ in. bore, launch engine, with a few details as to size, shape, number of water tubes, best material to make it with, &c.? It is not required for a boat.

A small condenser can be made from a piece of brass tube, 3 in. diam. and 6 in. long. Cut out two discs of brass, 1-16th in. thick, to



fit tight inside tube about $\frac{3}{4}$ in. from each end and drill thirteen holes in each for brass tube $\frac{1}{4}$ in. inside diameter. The two plates fit in the plates; clean all parts in contact and place in position and run solder all round the joints. The two outside plates, if made from $\frac{1}{2}$ in. brass about $\frac{5}{8}$ in. square, could have a groove turned 1-16th in. deep, in which the 3-in. barrel will fit with a water-tight packing between. One central 3-16th in. bolt passing through centre tube would hold the end plates in place.

[1261] **Winding an Eight-Cogged Drum Armature.** T. B. (Gomersal) writes:—Will you kindly describe the simplest method of winding an eight-cogged drum armature, either for a 4-part or 8-part commutator? Also, will ebonite be suitable to insulate the bars of the commutator? Please give the title and price of a good book on dynamos, more in particular the different methods of winding armatures.

The accompanying sketches show the method of winding an eight-cogged armature—Fig. 1 for a 4-part commutator, Fig. 2 for an 8-part commutator. In the second case, two coils are wound in each

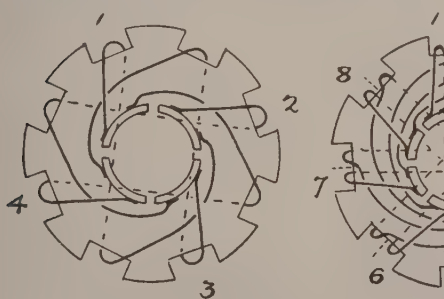


FIG. 1.

FIG. 2.

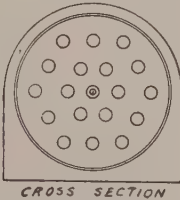
pair of slots, separated by a thin sheet of mica. Strips of wood half the width of the slot may be put in temporarily while the first coil of each pair is wound. Or the first coils may each fill half the slots, the second coils being wound on top of the first. Ebonite will suit for the insulation of the commutator. We can recommend Hasluc's "Dynamos and Electric Motors," which can be obtained from our Book Dept., 6, Farringdon Avenue, E.C., post free, 1s. 3d. This contains the information you require.

[1294] **Gas Engine for Automobile.** W. F. R. (Philadelphia) writes:—I should like to make the small 1-6th h.p. gas engine recently described in THE MODEL ENGINEER, of $\frac{1}{4}$ h.p. or $\frac{1}{2}$ h.p. to be adopted for an automobile, and to use acetylene gas. Can you inform me by what proportion engine would have to be increased (i.e., in dimensions) in order to answer such requirements?

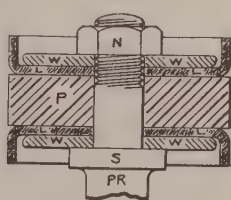
We cannot recommend you to use the type of gas engine you mention for the purpose of driving an automobile. The engine is designed especially for use as a stationary engine, and you would do much better to obtain a set of castings for an engine designed for the particular service from one of the many makers in the States.

[1297] **Hydraulic Piston.** W. O. writes:—As a reader of THE MODEL ENGINEER, I shall be glad if you will kindly inform me how to make a piston to work easily inside a piece of 3-in. tubing, and also how to make it water-tight. I am trying an hydraulic experiment, and it would greatly help me if you could give me this information.

We give a sketch of a suitable hydraulic piston, which will stand great pressure. PR is the piston rod with a broad shoulder forged at S. Beyond this the rod is continued, but of a smaller diameter, and is screwed at the end to take a hexagon nut. P is a thick disc of wrought iron slipping over the tail of piston rod, and must be turned slightly smaller than the cylinder in which it works. L1, L2 are two cup leathers, well greased, of the right diameter.



CROSS SECTION



These leathers are kept in place by the iron washers, WW, WW, the whole arrangement being held tight up against the shoulder S, by means of the screwed piston rod and nut N.

[1312] **Reverser for Motor.** A. J. H. (Camberwell) writes:—Would you kindly tell me whether the "Model Electric Tramcar Motor," described in the March and April numbers of THE MODEL ENGINEER, is reversible? If so, I should be glad if you would explain how to reverse it. A rough diagram would greatly oblige.

No reversing arrangement was given in the description of the Tram-Car Motor. We reproduce in the sketch herewith a reversing gear described by "A. W. M." in Vol. 1. of THE MODEL ENGINEER. The switch is made as follows: "Upon a square block of wood or other insulating material is mounted a brass disc, cut into four equal portions as shown; a stud fixed in the centre carries a bar of wood or insulating material, which is free to rotate on the stud. To the underside of the bar are fixed two brass springs (SS), as shown, which are not metallically connected together; these springs press upon the quartered brass disc. When the bar is moved so that the springs rest on F and T only, without

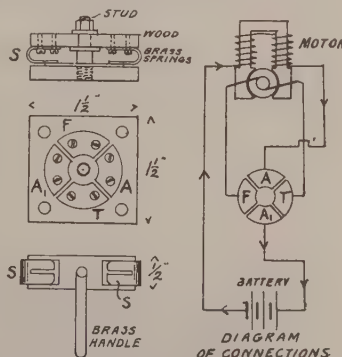


DIAGRAM OF CONNECTIONS

touching A and Ar, the motor is stopped; when the bar is moved an eighth of a revolution either way, and springs rest on FA and ArT respectively, the motor will be started. The movement to one side will send the armature rotating in one direction, and the movement in the other direction will reverse; a brass handle can be fixed to the bar as a reversing lever if desired. This switch can be fixed wherever desired, and the various connecting wires (shown in separate diagram) led up to it."

[1245] **Small Accumulators.** D. G. (Leeds) writes:—I shall be very glad if you will kindly answer me the following points out of your first handbook, "Small Accumulators: How Made and Used." I bought a copy of this book from you some little time ago with the express purpose of making a 4-volt pocket accumulator to light a scarf-pin, and also, when not used for this purpose, to light a watch light. I purchased a case, and got together all the other materials, and perforated the lead plates. I pasted the positive grids with a paste consisting of red lead and sulphuric acid, and

consider that these are all right. It states in your book that after having pasted and dried both plates place them in a very strong solution of chloride of lime. Will you please state how much chloride of lime there should be to a certain amount of water, and whether the water should be hot or cold when putting the chloride of lime in; and also how long the plates should stand in this solution, so that the action may be complete? Also, has the saturated solution of lead-acetate for the negative plates to be made in hot or cold water?

The chloride of lime solution should be a saturated cold solution, and the same applies to the solution of lead acetate. You will easily see when the action of the chloride of lime on the plate is complete, but to make sure, leave the plates in for half-an-hour.

Amateurs' Supplies.

[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.]

Pocket Galvanometer.

From the Universal Electric Supply Company, 47, Crosscliffe Street, Moss Side, Manchester, we have received particulars of a neat little pocket galvanometer which they supply, post free, for 1s. 6d. This should be particularly useful for testing electric bell and telephone circuits, the winding of field-magnet and armature coils in model dynamos and motors, and for other electrical purposes. This firm supply all kinds of parts, castings, and material for electrical apparatus, and will be pleased to send their complete lists, post free, to any reader mentioning THE MODEL ENGINEER.

Marine Photographs.

We have received a sample photograph of the Union Line s.s. *Norinian*, taken by Mr. E. C. Prince, 64, Cranbury Avenue, Southampton, which is a very creditable production and neatly mounted. Mr. Prince is making a special feature of supplying photographs of both the Union and Castle Liners and other well-known vessels, at the modest price of 7d. each, mounted, or six for 2s. 6d. These prints are quarter-plate size, but enlargements suitable for framing can be had at proportionate prices. Such photographs should be useful for readers intending to make models of any of these vessels, as well as for other purposes. Full price list can be had free on application.

Catalogues Received.

Whitney, The Scientific Exchange, 117, City Road, London, E.C.—A new edition of List B, containing description and prices of model engines, boilers, and fittings made by Messrs. Whitney, shows the extreme care taken to provide for every taste in the model-making line. Quite a large number of different sizes and types of launch, vertical, horizontal, and locomotive engines are listed, while boilers are in evidence for all classes of steam engine models. A speciality is made of model steam and other pumps, one of the neatest being a double cylinder direct acting donkey pump, suitable for either boiler feeding or supplying a small fountain. Fittings of all sorts find a place in this little list, which will be sent to any reader mentioning THE MODEL ENGINEER, gratis.

New Haddon Cycle Company, 5, Blackstock Road, London, N.—Those of our readers who are turning their attention to country sports and thinking of investing in a bicycle for that purpose, should write this firm for their list of "Hadders" and "Hians" cycles. These machines appear to be up-to-date, smart in appearance, and reasonable in price, all cycles being listed at nett retail price.

F. Mitchell & Co., Engineers, Tatsfield, Westerham, Kent.—A number of descriptive lists of the lathes supplied by this firm are to hand. These tools appear to be well designed, and are sold at a very moderate figure indeed. The 4-in. double-gear bench lathe is especially worth noting, being so designed as to be fitted at any future time for screw-cutting. Amateurs who want to get their workshop fitted in stages will appreciate this, as well as the very low price at which the lathe is sold. Such will do well to write to Messrs. F. Mitchell & Co. for their prices.

S. Bottone & Son, Electricians, Wallington, Surrey.—Röntgen ray motor, wireless telegraphy, Wimshurst machines, dynamos, motors, &c., form the subject matter of these price lists, which will need little recommendation to our readers. Mr. Bottone also includes a copy of directions for using wireless telegraphy apparatus, and prices for various parts for making up sets of same. Lists can be had from this well-known firm for 1s. 6d. in stamps.

C. A. Vandervell & Co., Thorpe Works, North Kensington, London, W.—A very full and detailed list of accumulators, dynamos, gas engines, &c., is to hand from this firm. Cycling readers should be especially interested in the large number and variety of electric cycle lamps, batteries, and complete sets, which are described, and others will find a plentiful selection of cautery and medical sets, portable lamps for various purposes, carriage lamp sets, x-ray batteries, and grids ready formed for making up batteries. Lamps

for photographic purposes and electric jewellery, scarf pins, &c., are included. Messrs. Vandervell also supply volt and ammeters, as well as many types of hand and other dynamos. Electrical lists will be sent for three stamps. Special gas engine list 1d.

D. F. Laing & Co., Electricians, 47, South Portland Street, Glasgow.—A useful and comprehensive catalogue is that issued by Messrs. D. F. Laing & Co., containing particulars of bells, telephones, and all accessories. An exceptionally large variety of pushes, batteries, switches, gongs, receivers and transmitters are shown, and the list should prove a useful one both to amateurs and the trade. Interspersed with the list are some excellent hints on fitting up bells and telephones, and remarks on the erection of telephone poles, lightning conductors, and on faults in telephone circuits. One shilling is charged for the list; 2d. extra being required for postage. Readers are requested to mention THE MODEL ENGINEER.

J. Beardshaw & Son, Limited, 118, Cannon Street, London, E.C.—A well printed and carefully prepared list of Sheffield steel goods made by this firm has reached us, and will prove of interest to many of our readers. In addition to a large variety of steel agricultural implements, files, rasps, tools, vices, hammers, &c., Messrs. J. Beardshaw & Son are large manufacturers of circular, band, and metal-cutting saws. An interesting speciality is the firm's "Profile" steel, rolled in various sections. The number of uses to which this tool steel can be readily adapted is surprising, engineers' tools of all kinds being readily and economically made from it with an absolute minimum of labour required.

A. G. Thornton, 68, St. Mary's Street, Manchester.—The catalogues of drawing instruments and drawing requisites issued by this firm are always up-to-date. Amongst other items, we have received lists of drawing boards and T squares, and a well-printed catalogue of an improved calculating slide-rule. Several advantages are claimed for this slide-rule, such as impossibility of warping, and comfort to the eyes when in use. Several samples of Mr. Thornton's tracing cloths and papers also reach us, and appear to be excellent value for money. The new edition of illustrated catalogue will be sent to MODEL ENGINEER readers, post free.

The British Cycle Manufacturing Company, 45, Everton Road, Liverpool.—A capital printed catalogue of cycles and accessories by the British Cycle Manufacturing Company is to hand, and well merits the attention of cycle readers. Gent's machines by this firm go by the name of the "Royal Ajax," ladies' bicycles being known as the "Silver Queen." The list is full of '99 specialities in the matter of lamps, saddles, pumps, mudguards, and other accessories, and every item and pocket appears to be cared for. Some general information and hints to new riders give the catalogue a more special value; it will be sent to anyone, post free, on mentioning THE MODEL ENGINEER.

S. Royals, Bird Cage, Godley Road, Halifax.—This is a brief list of various electrical sundries quoted at fair prices, and includes batteries, switches, motors, lamps, wire, and battery chemicals. The list will be sent free to any reader mentioning THE MODEL ENGINEER.

Notices.

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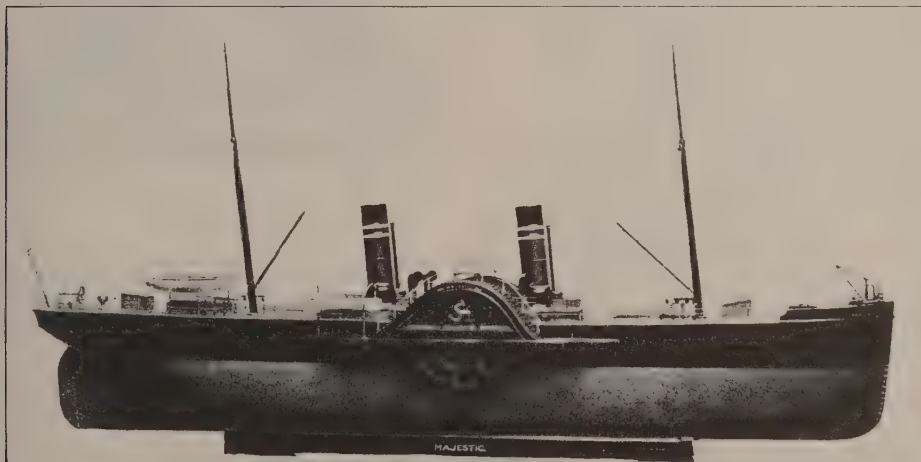
**My Model Paddle Steamer,
"Majestic."**

By S. L. THOMPSTONE.

BEFORE describing this model steamer, I should like to say I commenced model-making when 11 years of age. My first piece of work was a row-boat, built of laths 2 ft. 6 ins. long. This was followed by a pair of $\frac{1}{2}$ -in. bore oscillating cylinder

and burns charcoal as fuel with blast pipe; a $\frac{3}{4}$ -in. bore slide valve horizontal engine with pump attached, and brass bedplate, 10 ins. by $3\frac{1}{2}$ ins.; and a model of a brigantine, 2 ft. 3 ins. over all, with all fittings, etc.

My later work has included a small yacht with airtight compartments, about 1 ft. 6 ins. long; and a model of a barque, 2 ft. 6 ins. long over all, with masts made in sections, which will take down. This model was built in 1896, and took 360 hours to make. Since then, I have made a model hand-working force pump complete; a $\frac{3}{4}$ -in. bore oscillating double-action engine with four-



MODEL PADDLE STEAMER, "MAJESTIC."

engines; a $\frac{1}{2}$ in. bore cylinder engine with reversing gear to slide valve, and several horizontal boilers of the loco type. I also made a $\frac{1}{4}$ -in. bore oscillating engine with boiler attached; two vertical boilers, 3 ins. diameter, 7 ins. high, mounted on brass stands, with firebox, cross-tubes, water gauges, &c., the latter being rivetted, and will work at a pressure of 50 lb. per square inch,

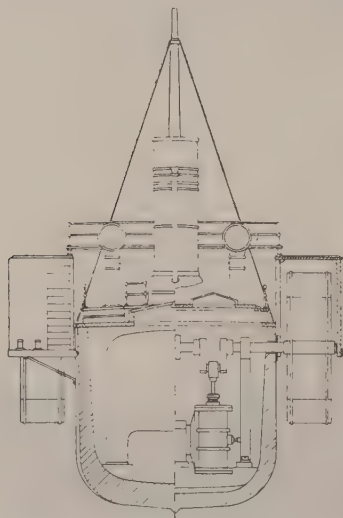
way tap for reversing; a model of a brass muzzle-loading field gun, mounted on brass wheels and carriage; a model cargo boat, *Magnetic*, and the model paddle steamer, *Majestic*, which forms the subject of this article. This paddle steamer I commenced in July, 1896, and it was completed in September, 1897, and took 550 hours to build. At that time I would be 19 years of age. As

in the case of the electric boat, *Magnetic*, which appeared in the June issue of THE MODEL ENGINEER, the hull was cut from a solid red deal block, 2 ft. 6 ins. by $4\frac{1}{2}$ ins. by $4\frac{3}{8}$ ins. deep, and hollowed out as shown on the drawings.

The boilers are made of copper 1-32nd. in. thick, square, with elliptical tops; the ends being flanged over the outside shell; the bottoms rivetted in, and the whole sweated with solder. The forward boiler is filled with water at the safety valve, which can be detached for that purpose, and the aft boiler at a screw man-hole; a pipe connects the two boilers in the steam space only. The aft boiler is the smaller of the two, and is provided with low water gauge tap. It will be noticed on the drawing that

the steam tap which supplies the engine with steam, is attached on the boiler about the water line; an elbow pipe from same is carried up to the underside of safety valve; by this means dry steam only is taken to the engine, and priming is thus prevented. The placing of the tap in this position was necessary, owing to the confined nature of the engine room. The rod attached to this tap enables the steam to be regulated from the deck.

The funnels are of 1 in. brass tubing carried through



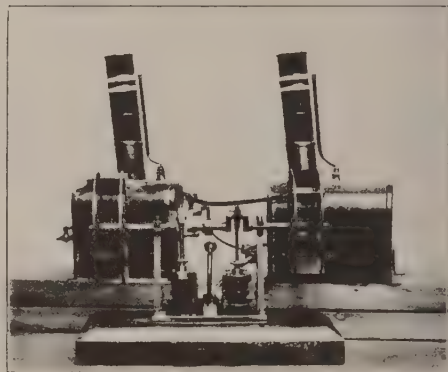
CROSS SECTION

the boilers, and have brass strengthening collars top and bottom of the boilers, which act as stays; there are also ornamental bands on the upper portion of funnels above deck line. About midway inside the funnels is fixed a fine wire mesh with $\frac{1}{4}$ -in. hole in the centre; this prevents the flame from the spirit burners rushing direct up the funnels. The usual steam escape pipe, with turned thistle-shaped top in front of the fun-

nels, carry away the escape steam from the spring high and low pressure safety valves. The boilers are fixed to lead blocks, and also have sheet lead lining under fire-boxes, which protects the hull from the heat, and they also act as ballast.

Fore and aft are provided two spirit tanks $3\frac{1}{2}$ ins. long, and average $1\frac{5}{8}$ ins. diameter; to the front of each tank is fixed a small tap with union and bent pipe, which carries the spirit to the circular burner with asbestos in it; these give off sufficient heat to produce steam and work the engine at a moderate speed. The spirit is supplied to the tanks through a small screw inlet at the top.

The engine is of the vertical direct acting type, with two oscillating cylinders $\frac{1}{2}$ in. bore, $\frac{7}{8}$ in. stroke, and bedded on two hard wood blocks, and secured in position between the two boilers amidships. The cranks are fixed on the shaft at quarter centres, so as to avoid dead centres. The crankshaft is 3-16ths in. steel rod, and in two parts, secured in the centre by a disc coupling with four small screws. It will be seen that this was necessary, in order to get it into the hold; to the ends of this shaft are attached the paddle wheels, which are $3\frac{1}{2}$ ins. diameter.



ENGINES AND BOILERS OF MODEL PADDLE STEAMER, "MAJESTIC."

and the sides cut out of 1-16th in. sheet brass. These are brazed on to a brass tube, which forms the boss, and there are eight floats to each wheel, secured between the arms.

The exhaust from the engine is delivered through the side of the hull, almost on the water line, under the aft port sponson.

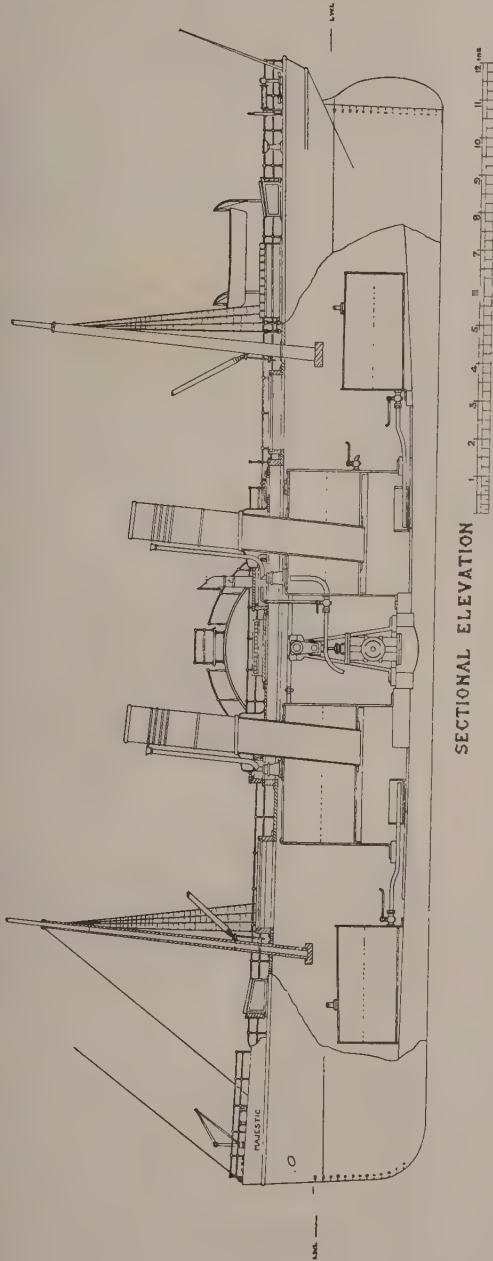
The decks are made of white holly, marked with indented lines to imitate planking. The forecask has upon it a fish crane for hoisting the anchors aboard, with mooring bitts and guides, and there are similar ones also on the sponsons, and at the stern.

The anchor chain runs through hawse pipes and the forecask to the capstan.

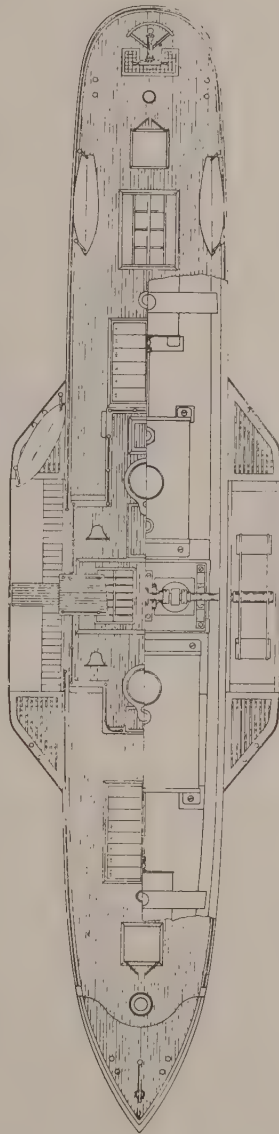
The forward companion way and the skylight aft lift up for the purpose of filling the spirit tanks; this is easily done by the aid of a small funnel.

The hatchways fore and aft lift up, giving access to the burners, taps, &c., as also do the small hatches over the safety valves.

The steering wheel is of brass, fitted with eight turned handles, and works the rudder by means of a quadrant, and in front of this wheel is a working compass.



SECTIONAL ELEVATION



PLAN

MODEL PADDLE STEAMER, "MAJESTIC."
 Drawings showing Sectional Elevation and Plan.
 (For description see opposite page.)

There are two lifeboats aft the mizzen mast, and two on the aft sponsons, hung on swinging davits.

The masts are of pitch pine, and are telescopic, being stayed in the hold by means of crossbearers, as shewn, and also by the shrouds which are secured to the deck by small dead-eyes. There is also a derrick to each mast, which adds more to the finish and completeness of the model.

On the raised deck amidships (which can be lifted up when required for cleaning purposes) are four dummy ventilators, and also a skylight over each crank of the engine. Around the funnels are placed two shaped copper protectors, covering the joining of pipes to safety valves, etc.

At each side of the hull are four fixed sponsons with turned brackets to strengthen same, and between these sponsons the paddle boxes (which have proper designed perforations on the outside) slide in grooves, which allows of easy removal of the paddle wheels and crankshaft, if the engine or boilers are ever required to be taken out, and are fixed in position by the bridge. The paddle boxes have steps and handrails leading up to the bridge, and there are also 10 doz. stanchions, turned from 3/64ths in. brass wire, and I may say fully three-quarters of these were turned and drilled by candle light, no gas being available at that time; they are fixed round the bulwarks and raised deck with a double row of thin brass spring wire threaded through each stanchion to form handrails.

In conclusion, I can wish for no better reward than that this necessarily somewhat lengthy description will be of interest, and may be a guidance to others who, perhaps, will be wishful to try and make something similar.

X-Ray Experiments for Amateurs.

By NESBITT O'D. BURNS, B.A.

MY excuse for writing this short article is, that although so much has been written on the Röntgen Rays from time to time, still, very little information has been given by any one on the apparatus for producing them in the best and cheapest way. I think that if it was more generally known, that a very good x-Ray apparatus could be obtained for the price of a cheap camera, more people would be induced to take up this highly interesting subject.

The ordinary arrangement for producing x-Rays is by means of a large induction coil, costing anything from £6 to £60, with a battery costing from £1 to £5, and a tube. Also the battery, if primary, needs a constant renewal of chemicals, and if secondary, needs continual re-charging; all of which means more money from time to time.

Now I have found that the coil, battery, and chemicals, costing at a very moderate estimate, £9 or £10, may be replaced by an electric machine of the kind known as a "Wimshurst," with 12-in. plates, which gives a spark of between 4½ ins. and 5 ins. long, and which may be bought without jars for about 35s. upwards.

The advantages of using this machine are, that its first cost is very little in comparison to that of a battery and coil;

that it needs no chemicals, and therefore is of no further expense to the owner; that if kept in a warm dry place, free from dust, it gives results equally as good as a coil of about the same length of spark; and that its construction is so simple that it has no parts liable to get out of order.

The Wimshurst machine (Fig. 1) in its simplest form, consists of two circular discs of thin glass or ebonite, which are placed close to each other, loosely, on a fixed, horizontal spindle, so as to be rotated in opposite directions. Each disc is driven by a leather band from a wooden pulley, of which there are two, placed on a spindle below the machine, and this spindle is turned by a crank handle. To the outer surfaces of both plates, are cemented from twelve to twenty short strips of tinfoil, at equal distances from each other.

There are two curved brass rods fixed, one on each side, to the ends of the spindle on which the discs revolve. On the ends of these rods are wire brushes, which touch at the same time exactly opposite pieces of tinfoil, that is, on opposite ends of the same diameter. These discs and rods are all that are necessary for producing the electricity, but to collect and use it "collectors" are necessary.

The "collectors" or "conductors" are two in number, situated to the right and left of the plates, one collecting

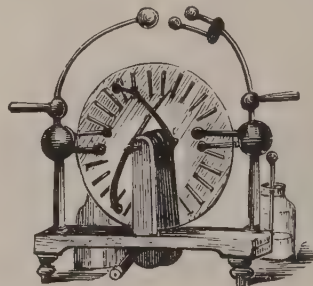


FIG. 1.—WIMSHURST MACHINE.

positive, and the other negative electricity. They consist of brass forks, which look towards each other, and towards the plates which revolve between them. On their inner sides are rows of metal points, which nearly touch the plates. The brass forks are mounted on insulated pillars, which prevent the electricity from escaping to the ground. From the conductors come movable brass rods, the "discharging rods," the ends of which can be placed at various distances from each other, and between which the spark passes when the machine is worked.

The pillars on which the conductors stand are often composed of small Leyden jars, but for x-Ray work it is better not to have these jars, as they are generally too large for the purpose. A Leyden jar is simply a glass jar coated outside and inside with tinfoil, and having a brass rod going through the cork, which rod is in connection with the inner coating. The jars do not make the spark of the machine any longer, and although they make it very much stronger, it is less continuous than without them.

So much for the machine. The next thing wanted is the tube. The tubes are of all prices, from 5s. to 35s., but one of the best kind is Cox's Record tube,

NOTE.—For the illustration of Wimshurst Machine in this article we are indebted to Messrs. Dollond, 35, Ludgate Hill, E.C.

which can be bought for 21s. This would be capable of showing the bones of the hand, foot, ankle, arm, and lower leg with the above machine. For holding it, a jointed wooden stand (Fig. 3), such as is used for chemical experiments, is the best. The cost of a mahogany stand as illustrated, is about 8s.

The tubes are of different degrees of exhaustion, for coils and machines of different powers; for instance, it would not do to purchase a tube that is meant for a machine with a 6-in. spark, when one has only a machine giving a spark of 4 ins.; for the machine would not be powerful enough to light it up. The best tube for the machine I have described is one suited for a 3½-in. or 4-in. spark. This will be well within the power of the machine, and when this is so, it is found that the tube acts best.

For actually producing the rays, these two arrangements—the machine and tube—are all that are necessary; but if we want to make them evident we must do so in one of two ways, either by the “screen” or by photography. As far as the photography is concerned, the necessary things are the plates and chemicals. Any good rapid plates will do, and their cost is—for half plates (the best to begin with) about 2s. 3d. per dozen, and for the whole plates about 4s. 2d. per dozen, on an average. The developer I have been using is the made-up “Metol” cartridge, one of which, costing 6d., will develop 1½ dozen half-plates. The fixing salt, hyposulphite of sodium, costs 3d. per lb., 1 lb. fixing about eight dozen plates.

The principle of the “screen” is this:—Röntgen rays have the power of exciting certain chemical salts to give off light, or “fluoresce,” so that when the “screen” is held up between the eyes and the lighting tube, it is seen to shine brilliantly. Now when any substance through which the rays cannot pass is placed between the tube and “screen,” it cuts off some of the rays, and so some of the chemical salt on the “screen” does not shine, and a “shadow” is formed. Thus, when the hand is placed in this position, we see the shadows of the bones.

These “screens” are expensive things to buy, but very cheap indeed if home-made, and practically as good for the amateur’s purpose as the bought ones.

Purchase ¼ oz. of calcium tungstate, costing 7½d. This will make two good “screens.”

Now get a bottle of gum, and a sheet of cardboard about 6 ins. by 4 ins. Spread the gum on the cardboard evenly and thinly, and sprinkle the tungstate carefully over the whole surface, leaving no lumps and rubbing it in evenly with the finger. A very thin layer of the salt is enough, if it is uniformly spread. When this is dry prepare a funnel of cardboard, and paste the “screen” against the wide end of it, with the prepared surface inside.

This funnel is for excluding the light, and the narrow end may be cut to fit the eyes. When this has been done we have made “Edison’s Fluoroscope.” Now we have all our apparatus ready for showing the rays, namely:

	£	s.	d.
Wimhurst machine	...	1	15 0
Tube and stand	...	1	9 0
Screen	...	0	0 7½

Coming to in all ... £3 4 7½
And if we include photographic materials, say:

1 dozen half-plates	...	0	2 3
1 Metol cartridge	...	0	0 6
½ lb. “Hypo.”	...	0	0 1½

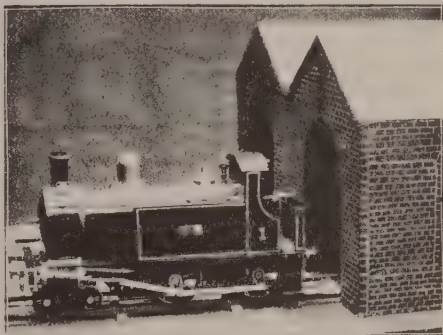
They come to ... 0 2 10½
Making altogether for the complete outfit £3 7s. 6d.

(To be continued.)

Model Railways.—I.

Col. Hamilton’s Model Goods Railway.

WHILE it is not every reader who is sufficiently fortunate to be resident within easy access of a model engine shop, where he can obtain his various parts and fittings, or have his models constructed under his own personal supervision, we imagine there are few who follow their hobby in so remote a spot as Colonel W. Hamilton, of Glenties, Co. Donegal, Ireland, who has been kind enough to furnish us with the accompanying particulars of his model railway. In writing to us some little while ago Colonel Hamilton said: “I may explain that my house is situated on a headland, almost an island, in the West Atlantic Ocean, and that the nearest town which boasts a photographer is fifty miles distant. You will therefore understand how difficult it is for me to get photographs of my line. A photographer occasionally visits these remote regions, and that is my only chance.” We think our readers will agree that it speaks volumes for the gallant colonel’s engineering enthusiasm that he has taken up his hobby in so thorough and practical a manner, in spite of the difficul-

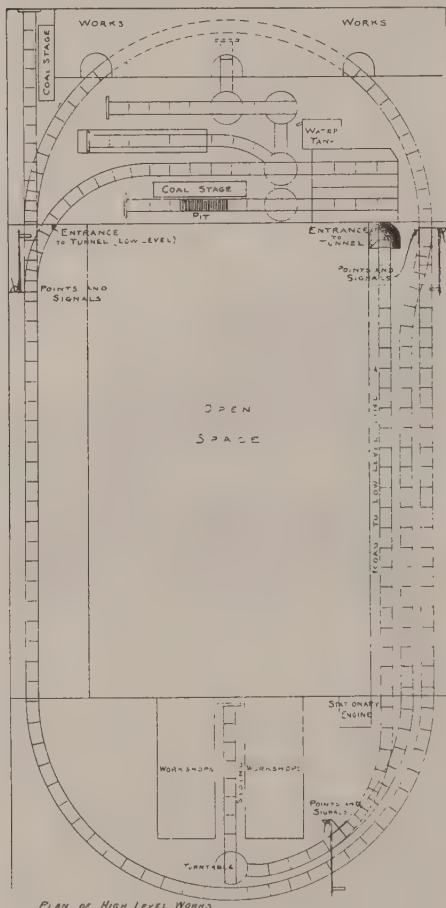


SHUNTING ENGINE NO. 1.

ties which his distant location must necessarily put upon him. Our illustrations show a plan of the general arrangement of the railway, and also a photograph of the No. 1 engine which is used for shunting purposes, and is made as short as possible on account of the very sharp curves on some of the sidings. The total length of this engine is 15 ins., and boiler is 9 ins. by 3 ins., including smokebox and firebox.

In describing his railway, Colonel Hamilton says:—“I may commence by saying that the whole of my system is only 20 ft. long by 9 ft. broad and 4 ft. high. I took my ideas from the Woolwich Arsenal works, in which I went through a course of instruction, and I need hardly say that I was quite charmed by the miniature railway there, as I am sure most of your readers would be. My ideas, however, lay dormant for many years, and it was not until a serious accident confined me to my room for many months, that I conceived the idea of making a model railway *pour passer le temps*. It was suggested by the description of a model railway I saw in the *Strand Magazine*, and I regret to say I only heard of THE MODEL ENGINEER quite recently, or I might have been saved a lot of trouble and useless expense. Pray excuse these personal details.

"The gauge of my railway is $2\frac{1}{4}$ ins. I have three locomotives, two tank engines, and one tender engine. I am sorry I cannot at present send you a photo of the latter. My rolling stock consists of trucks and waggons, and two brake vans, but I have no passenger coaches. The loco.'s are painted N.E. green, with black and white linings, brown frames, and vermilion wheels, picked out with black and white. The trucks and waggons are light slate, with letters and numerals white, shaded with



PLAN SHOWING GENERAL ARRANGEMENT OF COL. HAMILTON'S MODEL RAILWAY.

black; the brake vans indian red, lined with vermilion. The buffer boards of loco.'s are vermilion, with gold numerals, shaded with white; bright brass domes and funnel caps; buffer sockets black, picked out with white. I have a long truck on two four-wheeled bogies on the American principle in hand at present. My model buildings are supposed to represent a boiler works, and a coal

mine. The railway is for carrying the boilers (empty tins of sorts), sometimes of enormous dimensions, to and from the different parts of the works à la Woolwich, and to the main line. It also serves for conveying coal from the pit, which is on the low-level system, to the furnaces at the works. I may explain that the gradient is so stiff that connects the low-level railway with the high level, that I am obliged to make use of a stationary engine to haul engine and trucks up the bank. However, this used to be done on the L. & N.W. from Euston to Camden, which is a respectable precedent. This engine is of the ordinary horizontal type, and is also used for hauling the coals (pieces of cork stained with ink) up the coal mine shaft. The tunnel referred to in sketch is on the low-level system, and goes underneath the plateau on which the works stand. The rails through it follow almost the same curve as the one above. The radius is about 50 ins. I may add, that with this curve and the slow rate my loco.'s travel at, I do not find it necessary to elevate the outer rail of the curve. I do so, however, to a very slight degree to minimise friction. In some of my sidings, where the curves are necessarily very sharp, I elevate the outer rail fully $\frac{3}{4}$ in.

"I may mention that I designed and made all my rolling stock, except the loco.'s which were made from my drawings by Mr. W. Stevens, of the Model Dockyard, Aldgate. Please note that the piece of railway which appears in the photo is not my permanent way, but a length of temporary rails which I sent with the engine to the photographer."

A Small Electric Car Motor.

By A. P. DRAKE.

AS many young readers have found themselves unable, through not being the happy owners of a lathe, to build the electric car described in No. 6 of this journal, it is the intention of the writer to show how it may be done with very few tools. The original was made with the aid of a screwdriver, pocket knife, an old file, and bits of scrap metal to be found in any workshop.

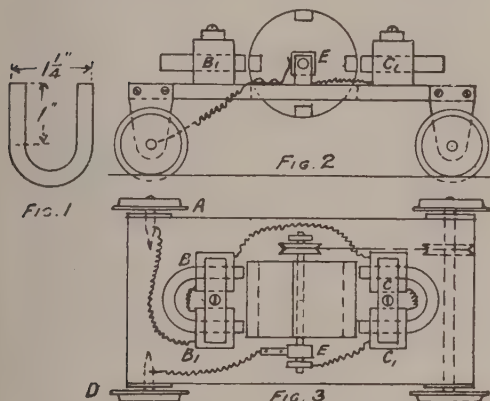
The base, or carriage, is a piece of wood, 6 ins. by 3 ins. by $\frac{3}{4}$ in. thick. A hole, $2\frac{1}{4}$ ins. by $1\frac{1}{2}$ ins., is cut $\frac{3}{4}$ in. from one side, and $1\frac{1}{4}$ ins. from one end of the base. We shall require two pieces of iron rod, 3 16ths in. diameter, and bent to form and sizes of Fig. 1.

Make four bobbins of stout paper to fit on these magnets, and wind them up until they are $\frac{1}{2}$ in. diameter with No. 28 single cotton covered wire. A round piece of wood, $1\frac{1}{2}$ ins. diameter and $1\frac{1}{2}$ ins. long, must now be mounted on a $2\frac{1}{2}$ ins. length of $\frac{1}{4}$ -in. round steel wire $\frac{1}{2}$ in. from one end. Divide the circumference of the wooden drum into four equal parts, and let in four pieces of soft iron, $1\frac{1}{2}$ ins. long by $\frac{1}{2}$ in. broad and $\frac{1}{4}$ in. thick. These must be let in level with the surface of the wood, and parallel to the spindle. In the model these figures are taken from, the soft iron armatures are held in place by a neat wrapping of small string, $\frac{1}{4}$ in. broad, placed in the middle of the drum. A better way would be to drill and countersink a small hole at each end of each piece of iron, and fasten them down with small countersunk head screws. A small piece of brass, 1-16th in. thick by $\frac{1}{2}$ in. square, must now be mounted on spindle in position shown in Figs. 2 and 3 at E.

The drum must now be mounted in a pair of bearings made from strip brass. These bearings are fixed so that the drum can revolve in the hole made in the baseboard, and must be of such a height as to allow the two opposite iron armatures on the drum to be exactly opposite the ends of the electro-magnets, as in Fig. 2. The electro-

magnets are secured to the base by a piece of wood made to fit on the top of the coils, and a wood screw is passed through it between the coils and into the base. They are placed so that the drum in revolving just clears the ends of the magnets; hence it is important that the spindle should pass through the centre of the drum. A piece of spring brass, about 1-64th in. thick, is bent at right angles and screwed to the base, so that it just touches the four corners of the square piece of brass on the spindle as it revolves.

The wheels may be mounted on axles or on short brackets screwed to the side of the base as is most convenient, only remember that one wheel must be disconnected from its fellows either by an insulating bush or by being mounted separately. The latter way is perhaps the best and also the more simple. Screw a piece of wood about $\frac{1}{2}$ in. wide at the top, and 5-16ths in. at the bottom to the base, the wood to be, say, $\frac{1}{8}$ in. thick. Then in the correct position screw on the wheel. The screw should be large enough to allow the wheel to rotate with-



out much shake, and should screw tightly into the wood bracket and project through the bracket about 3-16ths in. The connections are as in Figs. 2 and 3. From wheel A to starting end of coil B; finish of coil B to finish of coil B₁; start of coil B₁ to start of coil C; finishing ends of coils C and C₁ are connected together; the start of coil C₁ to one drum bearing E and contact breaker spring to wheel D. The ends of the wires to the wheels are soldered to the screws which project through the brackets. The drum spindle may be connected to the wheels either by a cord or by gearing, as is the larger electric car described in Nos. 6 and 8 of this journal.

The car is now finished, and should, if all connections are correct, work well with one bichromate cell. It should be said that for the above connections to be correct, the coils must all be wound the same way round, and must be placed on the magnets with, say, all the starting ends towards the bend, and the finishing ends at the poles. This method will often save confusion, as when both ends are at the same end of the coil, the amateur worker is apt to forget which is the start, and which is the finish.

The sketches are not to scale, and just show the relative positions of the various parts.

[Parts and materials for making this motor may be obtained from The Model Supply Company, 4, Balfour Street, Bradford.]

How to Make a Hand-Planing Machine.

By FRANCIS W. SHAW.

(Continued from page 148.)

HAVING procured the set of castings mentioned in my last article, the drawings and accompanying description should enable the "veriest tyro" to fit up a useful machine. But, before proceeding with the detailed description, I would say to those who may think it beyond their power to construct a workable machine, that however difficult this may appear, in reality, it is quite a simple matter. I have known lads who have only been a very short time at fitting, who could do very creditable work, and would not despair if set to fit up such a tool. I do not say—of course—that *anyone* is capable of fitting up an accurate machine, but I do say that any one of ordinary intelligence, and with a bent in this direction, who is willing to put his whole care and attention into the matter, can fit up a machine that will plane approximately true plane surfaces, given the tools and plenty of spare time and patient carefulness. Patience is the primary factor, and nothing good can be accomplished without it. It would be well to try to bear in mind when working, that, in such work as this, when the body is there, there is absolutely no reason why it should be removed unless requisite. If the work is truly lined out, with care and attention, these lines may be worked to. In planing leave the lines in, that is, on no account, cut beyond the lines.

In drilling, if the hole starts to run outside the circle described around the centre to denote its position, stop drilling the very moment this is apparent, and with a small chisel chip a new centre hole coinciding with the circle. Always describe the circle a shade larger than the intended size of the hole to be drilled, and in the case of large holes, inscribe several smaller circles to act as a guide to the eye in determining the direction in which the drill is cutting. Occasionally a few small blowholes, however small, will pull the drill from its true position, and great care should be taken in this case, as the further the drill is allowed to go without correction, the more difficult it is to rectify it. There will be many holes to tap, and care should be taken to get them tapped through square with the surfaces in which they are drilled. In most cases it is sufficient to judge by the sight, but when the efficient working of the machine depends upon the truth of the tapped holes, a square should be placed alongside the tap, and in the case of a taper tap, in at least three positions round the tap, its correctness being judged by the similarity of the angles formed between the square upright and the tap. At the risk of being tedious, I will repeat "Don't take metal away beyond the lines." And after this will pass on to the description of the parts.

Beginning with the foundation upon which the machine is built—the bed—I will give a few hints how to proceed, leaving the matter of tools, and how to fix the various parts on the machine table, as it is probable that the majority, if not all who have a larger machine, will already be initiated into its use. The only thing which I think may be neglected is the care which should be exercised in bolting up ready for machining. This should be done so as to avoid warping or springing the parts out of shape. Let all bolts be placed as near as possible to the packing blocks or bits of sheet iron, &c. Before taking the finishing cut, which, by the way, should be as light as possible, slacken all bolts off until only sufficient pressure is left to hold the work under a very light cut.

Having fixed the bed, plane up the slides marked a, b, c , and d , Fig. 3, leaving a small amount to finish after planing the vertical faces e , Fig. 1, and slackening off the binding bolts and clamps. Plane out the grooves f, f . This will ensure that when the uprights are fitted they will be square with the face of the bed. All the angles are 55 degrees. The table is now to be planed to fit, and an adjusting strip planed to exactly fill the space left; the table is also planed underneath to give a level bearing for the rack, which is also planed. The top of the table may be planed up, or left until the machine is completed and planed up on itself. The hole for the driving shaft may be roughly drilled, and finished by a boring bar in the lathe, the bed being mounted on the saddle; size of hole, $1\frac{1}{2}$ in. A piece of bright compressed steel shafting may be obtained for the driving shaft. Length of shaft 17 ins., turned down at one end to $\frac{3}{8}$ in. to fit the handle boss (Fig. 13), which is secured by a taper pin as shown. The handle lever is made from $1\frac{1}{4}$ in. by 5-16th in. flat bar iron, and slides in the boss, being secured in any required position by means of a set screw bearing on a key to prevent injury to the bar by the point of the screw. The handle is made of hard wood, and the pin is screwed into the bar and rivetted over at the back, a washer at the other end butting up to a shoulder, and rivetted on to keep the wooden handle in position.

The top surfaces of the bed (a and b) are now to be scraped up or surfaced perfectly level. These may be found rather uneven after leaving the planer, although the greatest care may have been taken. To do this work it will be convenient to have a surface plate. A small one will serve the purpose, but one which will cover the entire surface will be better for the job; or if neither is at hand, any true surface, as a lathe bed, may be requisitioned for the work. The scraping tools (scrapers) may be made from any old flat files forged thin at the end, and ground so that the end forms equal angles to each side.

In commencing, red lead or red ochre, mixed with oil to a thick paste, is smeared on to the surface plate, and the casting is rubbed thereon. The parts which stand highest will become discoloured, or, rather, coloured with red. If this show only in a few parts, a second cut flat or hand file should be used to rough it down quickly; but if the slide be covered nearly all over, the scraper is used for the purpose. The operation is repeated until the surfaces are clouded all over. At this stage the surfaces will be very nearly true, but if more perfection—if the term be possible—be desired, the colouring matter is smeared over the casting under operation, instead of the surface plate. In rubbing together the casting will become polished wherever a part projects from the normal surface, and these bright spots require scraping down. By degrees an approximately true plane is produced.

A surfacing strip the full length of the bed is now required, and for this the adjusting strip may be used, and, by surfacing in the manner already described the face which abuts the angular face d , "two birds will be killed with one stone." Using the strip as a guide, the face c is scraped level. Leave face d until the table is scraped up. Utilising now the bed as a surface plate, scrape up the faces under the table which lie upon a, b , and c , and it will be well to also true up roughly the part upon which the adjusting strip rests, and the top of the adjusting strip itself, for when the strip is tightened to the table by the set screws, if the fit is not good, the angular face will be warped. Bolt the strip down with five 5-16ths in. set screws (slot-headed), the two end ones to be about 1 in. from each end, and the others equally spaced between. To adjust the strip laterally to take up wear, four screw ends (threaded all the way) filed square at one end for the purpose of

screwing in by a spanner, are fitted, as shown in Fig. 1. The end ones are placed near to the ends of the table, but not as near as the binding screws before described. The face of the strip has been surfaced, and it will now be an easy matter to complete the remaining face (d). Work at this until the slide will move freely along from end to end without noticeable side play or shake, when in its remote positions.

The rack and pinion had better be fitted next. The pinion is bored $1\frac{1}{2}$ in. to fit the driving shaft, and turned up until it will just drop between the facings inside the bed (previously faced up), then pinned to the shaft by a taper pin, as shown. The rack must be planed so that the thickness will allow it to slide in between the under side of the table and the pinion, without the least degree of tightness. The rack is bolted on by four 5-16th in. cheese-headed set screws, the end ones being placed $\frac{1}{2}$ in. from the ends. Drill the screw-holes as near to the left side of the slot as possible. Place the rack in position and scribe off the holes, centre, and drill 17-64ths in. holes, or, instead of this, clamp the rack on and drill through the table into the rack—taking care not to go right through into the teeth—and open out the top holes to 5-16ths in. Countersink with a pin drill, so that the heads shall not project into the slot. Screw on the rack after tapping the holes, and drill two 5-16ths in. holes anywhere in its length through the table into the rack, and fit pins in to take the end thrust. Otherwise the screws, without this supplementary support, will, by reason of the constant strain which will be applied, gradually work loose. Drill oil holes through the bosses inside the bed, and also into the long boss outside.

All the drilling may—if necessitated by shortness of tackle—be drilled in the lathe by blocking up the castings in the various positions required, and feeding them up by the poppet or tailstock screw, the drills being held by a chuck fitted to the nose end of the headstock. In some cases it will be necessary to punch a centre directly opposite the hole to be drilled. It is surprising what really can be done, given a little ininventiveness, by poor machines, or machines otherwise unsuited to the job.

(To be continued.)

A SERIES of interesting experiments in wireless telegraphy with a balloon were recently conducted jointly by the Rev. J. M. Bacon, Mr. J. N. Maskelyne, and Mr. Nevil Maskelyne (of the Egyptian Hall), at Newbury, in the presence of a great concourse of spectators who had assembled at the annual gymkhana, given under the auspices of the Guildhall Club for Young Men in that town. The site of the gathering was a portion of the grounds of Shaw House. The first experiment made was the firing of a powder magazine, electrically, from a distant point without contact, the firing point being the transmitting station between which and the balloon communication was maintained when the ascent took place. The advantages of this system are claimed to be that there would be no connecting wires to be cut by an enemy, nothing which could fall into their hands, while no earthly power could prevent the communication from being established at the right moment. The initial experiment proved a perfect success. Mrs. Mackarness, wife of Mr. F. Coleridge Mackarness, Recorder of Newbury, touched a button attached to the powerful instrument in the electric station, with the result that at a distance of four hundred yards from the magazine the structure was instantly blown into atoms. Mr. Maskelyne explained that the same result could have been obtained with the same instruments at a distance of ten miles. Messages were afterwards transmitted from the electric station to the receiving station, with entire success.

For the Book-shelf.

[Any book reviewed under this heading can be obtained from THE MODEL ENGINEER Book Department, 6, Farringdon Avenue, London, E.C., by remitting the published price and cost of postage.]

SKETCHES OF ENGINE AND MACHINE DETAILS. By WALLACE BENTLEY, A.M.I.Mech.E. Halifax: F. King & Sons. London agents: Chapman & Hall, Limited. Price, 2s. 6d. net. Post free, 2s. 9d.

Viewed either from the standpoint of the young engineer who wants to understand the art of sketching machine details, or from that of the accomplished draughtsman who needs a good reference book of standard details, this work is an excellent one. It is, of course, primarily intended for the use of engineering students to whom the ability to make neat, rapid, and proportionate sketches is of the utmost value. One of the chief objects of the book is, therefore, to supply suitable examples, fully worked out, to show exactly the kind of thing required, whilst another—hardly less important—is to provide dimensioned details of the most recent and satisfactory shop practice. In both these objects, the author has been aided by some of the highest practical engineers of the day, and we are assured that the difficulty lay in selecting the most representative details from amongst the wealth of engineering material available. The result is an eminently useful book at a moderate price, which like other works by the same author, will go a long way to help the engineering student, the mechanical apprentice, and the practised draughtsman alike.

The Society of Model Engineers.

THE usual monthly meeting of the above Society took place at the South Kensington Museum on August 1st, as announced in our last issue, a fair number of members putting in an appearance, though, on account of the holidays, several well-known faces were missing. The members proceeded in groups to inspect the many interesting models and items of historical engineering interest to be found in the Machinery Section of the Museum, and a very enjoyable evening was spent. Mr. W. J. Tennant, A.M.I.Mech.E., member of the committee, proved to be a regular storehouse of information with regard to the various exhibits on view, and took considerable trouble to explain the special features of many of the models to the members, thus making the occasion very instructive for those present. Mr. A. M. H. Solomon, another member of the committee, has recently lent a valuable and most interesting collection of locomotive photographs to the Museum authorities, and several of these were on view in the annexe close by the "Rocket." Readers who may be visiting the Museum will find this well worthy of inspection. We may mention that it has been suggested that a regular model engineer's day be fixed, say once a fortnight, for visiting the Museum. It is admittedly rather monotonous for an individual to wander alone amongst the exhibits, but if by going on a certain day one would feel sure of meeting a kindred spirit with whom the various models of mutual interest could be inspected and discussed, then the pleasure and profit of a visit to the museum would be greatly enhanced. The matter is to be discussed at a future committee meeting of the society, and we shall report their decision in due course.

THE NEXT MEETING.

The next meeting of the society will be held at the Memorial Hall, Farringdon Street, E.C., at seven o'clock on Wednesday, September 13th. Members are requested to bring any models they may have recently

completed, or other items of interest. The committee will arrange for a discussion on a suitable subject, and hope to be able to make some announcements of interest with regard to future arrangements. All members are requested to make a strong effort to be present. Readers of THE MODEL ENGINEER who may be thinking of joining the society are cordially invited to attend as visitors, and in this connection it may be mentioned that the society is likely to make considerable progress during the coming winter session, as some very attractive meetings are being arranged.

DONATIONS TO LIBRARY.

Since the appearance of the last issue of THE MODEL ENGINEER, the following books have been kindly presented to the society, and are now available for members: "Electricity and its Uses," by J. Munro; "The Locomotive Engine," by G. D. Dempsey, C.E., and D. Kinnear Clark, C.E.; and "The Development of the Locomotive, a Popular History," by Clement E. Stretton.

Jottings.

DR. PETER STIENS, the Russian scientist, who is now in England, has been carrying out a long series of experiments in connection with the perfection of a system of telephoning without wires, just as Sir W. H. Preece and Signor Marconi have been able to telegraph without wires. Dr. Stiens, in an interview with a Press representative, said:—"By the use of this invention two persons long distances apart, provided they each have my little apparatus, can converse just as easily and distinctly as with our well known system of wire telephones. Nay, more so, for I claim that by the use of this invention I shall be able to speak from London with persons, say in Antwerp, or even in New York. Very shortly I intend to carry out some experiments—or rather demonstrations—on the Thames, when I shall prove, in the presence of scientific experts and others, the genuineness of my invention. I have worked at it for years in the laboratory and elsewhere, and, if I may say so, with successful results. The invention has now passed beyond the area of experiment, so to speak, but, of course, I must demonstrate in the presence of electrical experts to prove its efficacy to the world. I have already proved it to my own satisfaction, and have spoken over various distances with good results."

A novelty in workshop appliances is an electrically heated soldering iron intended for soldering wire, electrical connections and other articles. The current is taken from an ordinary lamp socket through flexible lamp cord, and only a trifle more is required to heat the coil than is necessary for a 16 c. p. incandescent lamp. It is stated that this electrical soldering iron is now preferred by electricians in their work on account of the uniform heat obtained.

Demonstrations have lately been given in London of a new process of printing without ink. A chemically-prepared paper is used, but the printing is performed on any ordinary printing press, which may be adapted for the purpose at a slight cost. At the moment of contact between the type and paper an electric current is passed through the former, with the result that a clear and legible impression is instantly produced on the surface of the paper. Numerous advantages are claimed for the process, among them being economy in labour and material, and increased speed in printing. The Electrical Inkless Printing Syndicate, Limited, is the title of the people who are developing this interesting invention.

Model Yachting Supplement.

H.M.S. "Curacoa's" Model Yacht Club.

AT the opening cruise of the "Curacoa" M.V.C., held in Campbelltown Loch, six models started, viz.: Captain Lyon's 10-rater *Alpha* (sailed by Mr. Behenna), Mr. Behenna's 10-rater *Brenda* (sailed by Mr. Perry), Mr. Mitchelmore's 10-rater *Problem*, Mr. Martin's 5-rater *Bluebell*, Mr. Well's 5-rater *Olga*, and Mr. Lanyon's 5-rater *Q.E.D.* The little craft were started opposite the ship, and presented quite an interesting sight, being watched by many persons on the shore and by the crew of the ship, by whom the merits of the respective favourites were freely discussed. The course was a beat to windward rounding the culvert

McCarkindale, *Negro*, 23-rater, Mr. A. McCarkindale; *Falcon*, 45-rater, Mr. John Paterson. The course was a beat to windward to a buoy off Ship Yard and a reach to a buoy off the lifeboat house, leaving both buoys on the starboard hand and a run back to the starting-point just off the pier. The race proved very interesting, both to the spectators on shore and aboard the ship. *Olga*, *Q.E.D.*, and *Bluebell* taking the lead up to the first buoy. *Q.E.D.* was the first boat to get round after much excitement, but the smaller boats were soon overhauled and at the finish the order was: (1) *Brenda*, Mr. Behenna (sailed by Mr. Perry); (2) *Falcon*, Mr. Paterson; (3) *Negro*, Mr. A. McCarkindale; (4) *Q.E.D.*, Mr. Lanyon; (5) *Alpha*, Captain Lyon (sailed by Mr. Behenna); (6) *Problem*, Mr. Mitchelmore. *Olga*, *Bluebell*, and *Wasp* did not finish. *Falcon* allowed *Negro* 2 minutes, *Wasp*



H.M.S. "CURACOA."
10-Rater
Problem.

10-Rater
Olga.

10-Rater
Brenda.
5-Rater
Q.E.D.

10-Rater
Alpha.
5-Rater
Bluebell.
5-Rater
Olga.

buoy on the port hand and a run back to the ship. The three 10-raters made a pretty struggle for first place, each heading a turn, but eventually *Alpha* wrested the lead from *Brenda* and came in first, *Brenda* second, *Problem* third, *Q.E.D.* fourth. The wind dropping *Olga* and *Bluebell* did not finish. This club is an off shoot from the Port of Plymouth Model Yacht Club, and has only just started. The first match was held in Campbelltown Loch on May 13th, 1899, nine yachts started at 3.33 p.m., viz.: *Problem*, Mr. Mitchelmore; *Alpha*, Captain Lyon (sailed by Mr. Behenna); *Brenda*, Mr. Behenna (sailed by Mr. Perry); 10-raters. *Olga*, Mr. Ward; *Bluebell*, Mr. Martin; *Q.E.D.*, Mr. Lanyon; 5-raters, belonging to "Curacoa" Yacht Club. *Wasp*, 20-rater, Mr. F.

3 minutes, the 10-raters 4 minutes, and 5-raters 7 minutes, which time was given at the start. On the ship's arrival at Pembroke Dock, the long promised race between Mr. W. Noble's *Ibex*, of Tenby Model Y.C., and the "Curacoa's" models was arranged, and a friendly spin sailed on Saturday, July 22nd. Mr. Mitchelmore's 10-rater, *Problem*, Mr. Perry's 10-rater, *Brenda*, and Mr. Behenna's 5-rater *Olga* met the *Ibex*, which was measured $\frac{L \times SA}{6000}$ Rule, and certified 18-rating. A run

and beat was decided on, but owing to the very strong tide running, each led, and was swept away by it in turn. *Olga* kept close in, and rounded the point, but was soon passed by *Problem* and *Ibex*, and keep-

ing close in, ran up and stretched across H.M.S. "Curaçoa's" bows, *Ibex* leading, then *Olga*, and *Problem*. *Brenda* gave up on getting in the strength of the tide. The race gave but little of the actual merits on account of the tide. *Olga* was within her time allowance. Two hours afterwards, *Ibex* and the seven models of the "Curaçoa's" club were towed to Pennar annual regatta, by the steam launch of H.M.S. *Northampton*. The small rowing boats, each with its model on board in tow of the launch, was a novel sight and was much commented upon by the crews of the men-of-war and destroyers of the "B" section of the mobilised fleet in Milford Haven. The Pennar Regatta Committee marked out a triangular course of about a mile, and got the little craft away well together. Starters: *Ibex*, 18, Mr. W. Noble; *Alpha*, 10, Captain Lyon (sailed by Mr. Ward); *Problem*, 10, Mr. Mitchelmore; *Brenda*, 10, Mr. E. Perry; *Clown*, 10, Mr. Martin; *Q.E.D.*, 5, Mr. Lanyon; *Bluebell*, 5, Mr. Stephens; *Olga*, 5, Mr. Behenna. The wind was rather light, and *Ibex's* large sail spread soon put her in first position; *Brenda* was second round the first mark; *Alpha* third, *Problem* fourth, *Clown* fifth, *Olga* sixth; *Bluebell* and *Q.E.D.* retired. In the run to the next mark *Olga* passed *Clown*, the others remaining as before stated. *Brenda* saved her time allowance on *Ibex*, and took first prize; *Ibex* second, *Alpha* third, and *Problem* fourth; *Olga* was fifth, but did not save her time. The race was seen from the shore by a crowd of people, and the sailing of the models was favourably commented on. Mr. Noble and his three Tenby friends were pleased with their visit to H.M.S. "Curaçoa," and the members on board showed them everything of interest.

[Mr. W. Noble, of Tenby, has also sent us an interesting account of the above racing, but as his report covers the same ground, it is not necessary for us to reproduce both. We may add that Mr. Noble writes in very high terms of the hospitable reception he and his friends received when visiting the "Curaçoa," and of the model yachting enterprise and enthusiasm which exists on board.—Ed. M.E.]

The Construction of Paper Model Yachts.

By A. FORDSMITH.

PRESUMING that you have fixed on the shape of the vessel you intend making, and have prepared the drawings, the deck is the first portion to put in hand. This must be made nicely and true, and for a 10 tonner should be $\frac{3}{4}$ in. thick. Now lay this on a board $\frac{3}{4}$ in. thick, and mark round with a lead pencil to cut out a *facsimile*. If possible, it would be as well to dress the

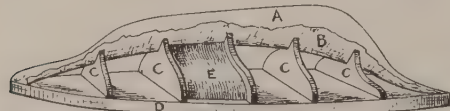


FIG. 1.—A, Permanent Keelson; B, piece of paper to allow Keelson to lift up; C C, Sections; D, Deck-board; E, Cardboard in position to receive plaster of Paris.

edges of the deck and deck-boards together to get them exactly the same size and shape.

Put the deck on one side and proceed to make the solid sections C C C C (Fig. 1); dress the edges, the bottom and sides can be left rough; cut a taper slot in each to receive the keelson; drive $1\frac{1}{2}$ -in. sprigs through the

sections as shown by dots in Fig. 2, about 1 in. from the edges. Then fasten the sections in their relative positions on the deck-board.

The keelson is the next business. This should be well made, as it is a permanent part of the ship. (A, Fig. 1.) Taper at the inner edge; then put in position as Fig. 1, resting in the slots, with a piece of paper between as B, Fig. 1, and must lift off easily. Fasten it in position by two screws through the deck-board at bow and stern. Next procure some common cardboard. The drapers, shoemakers, or hatters, are glad to part with their old cardboard boxes, and nothing better can be used for the purpose. Cut three thicknesses and fit between the sections resting against the sprigs; drive a few sprigs on the outside to keep in their places. All is now ready for the plaster of Paris. Mix about a pint of plaster to the consistency of mortar, and with a trowel or large table-knife plaster up one section at a time against the cardboard, modelling and fashioning until all is nicely level with the edges of the sections, and worked and curved smoothly up to the lower edge of the paper B, but not to touch the keelson. Clean

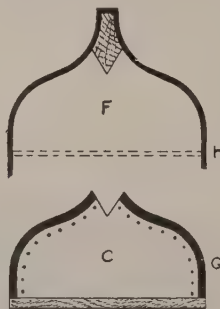


FIG. 2.—Section of Hull lifted off the mould; F and C, Sections; G, Plaster of Paris. Dotted line H shows position of deck.



FIG. 3.—Section of Fin Keeler and Double Fin Model.

your trowel and mix fresh plaster for each division, and finish by modelling the bow and stern. When set, give this a good coat of boiled oil. When the oil has soaked into the plaster and the edges, cut the paper B down to the plaster; the mould is now ready for making the hull.

As it is the nature of paper to expand when damp and contract in drying, we will take advantage of this peculiarity.

The more coarse and porous the brown paper for this purpose the better. Cut strips about $2\frac{1}{2}$ ins. wide and 5 ins. long; and, to make them perfectly damp but not wet, take one at a time and lay it on the board, and with a sponge or cloth wet the upper side only, and on this put another strip of paper and treat the same, so that each piece has a dry side in contact with a wet surface of the one underneath, and so on until you have sufficient for the time. In two or three minutes they will be ready.

Half ordinary paste and half glue is next mixed in a glue kettle, and this should be kept hot during manipulation. Have a bowl of hot water by your side to dip your hands in occasionally. Then proceed to glue an inch of the keelson, using a strip of the damped paper as a fender to keep the glue off the plaster. Take the strip and press it on the glued part of the keelson. Do this all the way round from stem to stern. On these again glue other strips, holding each fresh piece as a fender while

you glue the one above, putting each paper like slates on a roof, so that the glue does not come in contact with the sections or plaster. Continue this until it is all covered, and hanging about $\frac{1}{4}$ in. below the deck board. Continue covering this with more paper, working regularly round from stem to stern. Dip your hand in the hot water and rub well down, but don't use too much water, only enough to allow your hands to slip on the surface, and keep all tight by occasionally putting a few tacks through the paper into the bottom edge of the deck board. You can see the progress by the part hanging below the deck board; the thickness should be 3-16ths in. for a 15-rater, $\frac{1}{8}$ in. for a ten, and 1-16th in. for a five. This part of the building may be done at intervals of time, the slower the better, and it must not be removed from the mould until *absolutely* dry and hard, as now it is in a violent state of tension, and once it dries out of shape nothing can bring it back. Unscrew the two screws that held it to the deckboard at the bow and stern. It will now lift off the mould (Fig. 2), and you will be surprised what a light, strong hull you have. Sandpaper the outside until you have a smooth surface, and proceed to make it impervious to water by thoroughly coating inside and out with boiled oil. Two or three coats would not be amiss. When dry, cover the inside with shellac varnish and one coat of paint on the outside.

The deck being all ready with fittings, &c., fit in its place and screw to keelson at bow and stern, and drive small brass nails through the sides into the edge of the deck. Make this joint waterproof with shellac; varnish in the following way. Take, say, a tablespoonful of varnish and pour on the gunwale joint. Tilt the boat gradually, allowing the varnish to run round and fill the joint. When set, cut the ragged edges of the paper level with the deck, and pour the same quantity of varnish inside, tilting the boat so that it runs round, filling the inside joint.

Now for the lead. You can try the trim by tying it on the boat against the keelson and floating in an ordinary bath. A good way to bore the holes in the lead is to have the lead in water when you use a brace and bit. Fit the lead on, and give several coats of paint, and you have a water-tight, strong, light boat, much lighter and stronger than wood.

The same process may be used in the construction of a fin keeler or double fin boat, the only difference is the shape of the keelson, as Fig. 3; of course, the sections would have to be made in accordance with different shape of hull.

One great advantage in that method of construction would be: when a good mould was made in a club, members could make boats from it, and as they would be much alike, the result would be an increase of sport, and prizes would be better distributed amongst the members.

Model Yachting at Lowestoft.

WE are indebted to Mr. F. J. Tansley for the following interesting particulars of model yachting in the Lowestoft district. As some of our readers may be aware, a special class of boats known as "beach-yaws," are greatly favoured in this locality, and they are undoubtedly capable of very excellent performance. We are pleased to be able to reproduce the accompanying photograph of Mr. Tansley's model beach-yawl, *Happy New Year*, the picture also showing the fastest cutter in the Lowestoft Club. Our correspondent writes:—"I have enclosed a few particulars of the model beach yawls at the Lowestoft Pond, for which there is a separate class. The only restrictions are the length over all, 50 ins., beam and depth optional. They are

long, shallow boats with flat floors and a clean run, and somewhat round bow and forefoot. The keel is of moderate depth, and weighs from 10 lb. to 14 lb. The boats are fitted with two lug sails, four suits being the outfit for racing. They are lightly rigged, and have two sets of spars and four or five rudders of various weights and sizes. Those models of moderate dimensions give the best results, and I give below the average dimensions of a typical model which will fairly represent the rest:

Length, over all	...	50 ins.
Depth midships	...	3 $\frac{1}{8}$ "
Breadth fore and aft without keel	...	5 $\frac{1}{8}$ "
Beam	...	10 $\frac{1}{8}$ "
Keel	...	2 $\frac{1}{2}$ to 3 "
Foremast	...	31 $\frac{1}{2}$ "
Mizzen-mast	...	28 $\frac{1}{2}$ "
Outrigger out board	...	20 "
Foreyard	...	27 "
Mainyard	...	22 "

Storm masts are about 5 ins. shorter. In reaching these boats are very fast and steady; but in beating the fore-lug, which is hooked to bumpkin on the stem, has to be shifted when tacking. The boats are very popular here, and have been the favourite type of model for over eighty years. Formerly three lugs were used, but this rig has



entirely given place to the more graceful and handy fore-sail. Sometimes booms have been tried, but the speed of the boats is not improved by them. Under sail they make a very handsome show, and the beach-yawl proper is no doubt the handiest and fastest open boat afloat. Our models on the pond do the length (125 yards), with a fresh reaching breeze, in from 65 to 75 secs., and close-hauled the average is 80 to 85 secs. The Lowestoft pond is one of the best in England, situated on the open Deens, north of the town, with a commodious boathouse and an attendant to take care of the models, for which a small charge for storage is made. Members of other clubs will always be welcomed, and a race can be arranged at any time by the genial commander, Mr. T. E. Thirtle, or his son, Mr. A. Thirtle. I have enclosed a photo of my yawl, *Happy New Year*, and the *Britannia* cutter ready for starting, taken by my son, R. P. Tansley. She is a fairly representative yawl, and the cutter is the fastest boat in the club, beating, or on a close reach. This photo will give a good idea of what our models are like. I shall be glad to give any information to any of your readers who may be interested in our local craft."

We may add that Mr. Tansley has been connected with the Lowestoft Old Company of Beachmen and their yawls for many years, and is therefore an excellent authority on the matter about which he writes above.

Correspondence.

{The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication. Communications should be written on one side of the paper only.}

Model Yacht Measurement Rules.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Next to the $\frac{LWL \times SA}{6000}$ Rule, I consider

Captain Gillett's formula, $\frac{L + B + D + \sqrt{SA}}{2}$, the

best rule to adopt for getting at the actual power of a model. It gets at the points better than our rule; but I am sure the $\frac{LWL \times SA}{6000}$ Rule numbers more models,

i.e. up-to-date ones, than any other one rule in Great Britain at the present date, and it would be a great point gained if all clubs would work to it on trial for the year 1900, and start the new century with such a formula as suggested by Captain Gillett, who has been sailing models, like myself, for many years, in various foreign waters, and under all conditions.

We are to visit Guernsey the end of August, and we hope to arrange a match with our Guernsey confrères with whom I am in correspondence.—Yours faithfully,

H. M. S. CURAÇOA, Wm. F. BEHENNA,
Pembroke Docks. Hon. Sec.

TO THE EDITOR OF *The Model Engineer*.

SIR,—In your August number, Mr. William Cubbin is annoyed at my venturing to criticise measurement rules under a *nom de plume*. In such discussions I think the identity of a writer should be of less importance than his arguments. Let us suppress the writer individually, and confine ourselves to his contentions. In this way, personal animus will not figure in the discussion of topics of general interest.

To support my previous letter I would add that, as far as the Plymouth L. & S. A. Rule is concerned, the range of choice of dimensions which Mr. Watson gave was interesting, but, to my mind, impracticable. I have not seen many 10-raters of 30 LWL or 20's of 40 in LWL, and I believe a choice of such dimensions would not frequently be made. Could I not therefore ask, without being complained against, for the most popular dimensions of the Plymouth Club?

It is generally conceded that a weight class produces light displacement boats of great beam and draft, and one can therefore generally "fill in the details" of dimensions of such a class. The expression "give the show away" is used generally in a sense of good-humoured banter, and is not necessarily offensive.

I do not favour any rule in particular, but I do favour a certain principle in taxing yachts, and that is those dimensions which conduce to sail-carrying power should be taxed and not the sail itself. It may seem the same thing to tax sail as to tax sail-carrying power, but it is not so, I think. For example, a 10-rater is built of a certain water line length, and it is found that with the draft and beam selected, there is not sufficient power to carry the sail allowed. The keel is therefore deepened, but no tax on the boat ensues, and the proportion of draft to the size of the boat is therefore often outrageous. The boats cease to be legitimate models of even the class of unseaworthy vessels they are supposed to represent. No one acquainted with yacht designing needs such arguments to convince him of the absurdity of unlimited draft in models. In

large vessels, the draft is governed usually by limits not controlled by the designers even when there is no tax.

As for the Edinburgh and Leith Rule, I simply said that draft got off free, and I am sorry that I offended anyone by doing so.

If a rule can be adopted as a vote taken amongst model yachtsmen after the subject has been thrashed out in this correspondence, the administration of it could be controlled by a Council, which might be constituted as a Model Y.R.A., and competitions conducted under such a rule would be vastly more interesting than the medley of measurement and sailing rules now in force in different clubs. It is what every model yachtsman wants, but each seems to be biased in favour of the rule he has had most experience of, and will not allow a "fair criticism" if it is opposed to his own views.

Please excuse the length of this communication.—Yours, etc.,
"SAIL TONS."

Model Yacht Steering Gear.

By W. CUBBIN.

THE accompanying sketches show the steering gear in general use by members of the Port of Plymouth Model Yacht Club. It differs from Mr. Scott's gear as published, although the triangle is the principle followed (see Fig. 1).

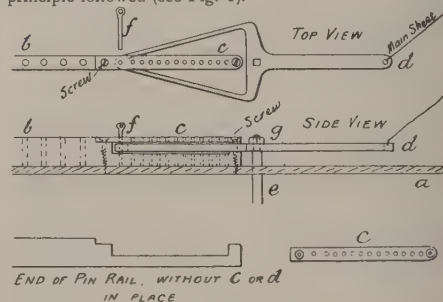


FIG. 1.

The majority of models have a pin rail for main sheet on the deck from mast to rudder-head. A slot is cut in the end near rudder in order that c can be screwed on and leave a space for d to work clear in. The steering gear has a square hole cut in it to fit over helm post and is secured by screw nut. A pin is used for governing the

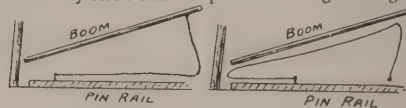


FIG. 2.

action of the triangle. When it is in the first hole of c it is also through a hole in end of or point of d, and through b, and the rudder is locked at dead centre. When rudder action is required, the pin is placed in one of the holes of c nearer the rudder, and is clear of the triangle, which has then full play according to helm required. The holes marked on c have corresponding holes in b reaching to deck.

The main sheet is fastened to end d or through hole at end of d to pin in rail on deck (as shown in Fig. 2), according to wishes of individuals.

Racing Reports.

Open Competition at Cardiff.—The race arranged in connection with the Roath Park M.Y.C. for a model yacht and other prizes, took place on July 29th, in beautiful weather and with a nice sailing breeze. Nineteen competitors took part, six models coming up from Swansea. The first heat brought out nine models, and a fresh breeze from W. gave a broad reach out. At the turn for home the wind headed the models a little, and they came back close hauled. *Gloria* and *Utopia*, of the Roath Park Club, with *Lady of the Lake*—Swansea M.Y.C.—finished in the order named. *Lady of the Lake* and all the Swansea boats, in fact, were greatly hampered by weeds, being double fin models and readily catching any floating obstruction. For the second heat the wind came lighter, but with a little N. in it, and sheets were checked home a trifle. Larger suits were carried, and this heat was a very fast one. Of the ten models in the heat, *Ivor*—Cardiff M.Y.C.—was first, with *Navis* and *White Swan*—Roath Park Club—second and third. The final heat promised to be very interesting, as the wind had gone to N.E., and gave a true beat out. *Gloria* and *Utopia* held a good course, *Gloria* in particular pointing high and moving well. *White Swan*, sailing freer and reaching faster, was leading at the end of the first round, but *Gloria* had a better berth to windward for the beat back. On this round she worked out a good lead, being well trimmed and with everything drawing. *Navis* drew up after a bad start, and passed *White Swan*. *Lady of the Lake* was well sailed, but it was evident that the strange surroundings, coupled with the weed catching, did not favour her, and although Mr. Cozens made no mistakes in putting her through her work, he was very much handicapped by these circumstances. Owing to the wind dying away it was getting late when the boats were coming in, and the course was shortened. *Gloria* (Mr. A. Llewellyn), won a good race, with *Navis* (Mr. Eastbrook) second; and *White Swan* (Mr. Angle), *Lady of the Lake* (Mr. Cozens), and *Ivor* (Mr. Burgess) in the distance. The Swansea boats were all of light displacement and carried low sail spreads. They suffered from this when the wind lightened, whereas the Roath Park models carried more sail aloft and less on the foot. In a breeze the Swansea boats were fast and weatherly. The weeds, owing to the hot weather, had been growing in the lake very fast, and although gangs of men had been employed for weeks clearing them out—£400 being spent last year for similar work—there were still in many places loose pieces floating about, and the Swansea boats caught all they could find. The sailing rules permitted the clearing of weeds off the models at any time during the race, but this did not help matters very much. The Swansea men made no complaint, much as they were handicapped. It is to be hoped that they will pay many future visits to Cardiff, as the competition was conducted throughout in the pleasantest manner. This visit was their first, and the contest was sailed under the rules and tonnage measurement of the home club, the models being accompanied during the race by rowing boats.

Cardiff M.Y.C.—On Saturday, June 10th, the Cardiff Model Yacht Club sailed the second race out of five to take place this season, for a silver cup given by Captain M'Neil. On June 17th, a club prize was sailed for under the new tonnage rule. On Saturday, June 24th, the club sailed the second race this season for the cup given by Mr. T. A. Reed, R.N., in the Jubilee year. On Saturday, July 1st, the club sailed for a prize given by the hon. secretary, and on Saturday, July 8th, the third race this season was sailed for the prize given by Captain M'Neil.

How to Make a Double-Acting Air-Pump for Testing Models.

By B. SHAW.

MANY amateurs will find it a great convenience and very useful to have an air-pump at hand with which small steam engines, &c., can be tested and worked by a constant supply of compressed air, such as can be got by the pump here described, and which can soon be made without much labour.

First procure two ordinary cycle pumps about $1\frac{1}{2}$ in. bore and 12 ins. long and saw off the small delivery pipes at the bottom end of the barrel; then drill out the small hole to 11-32nds-in. diameter, tapping them out with a $\frac{1}{8}$ -in. gas tap to receive the delivery valve casing marked A in the drawing



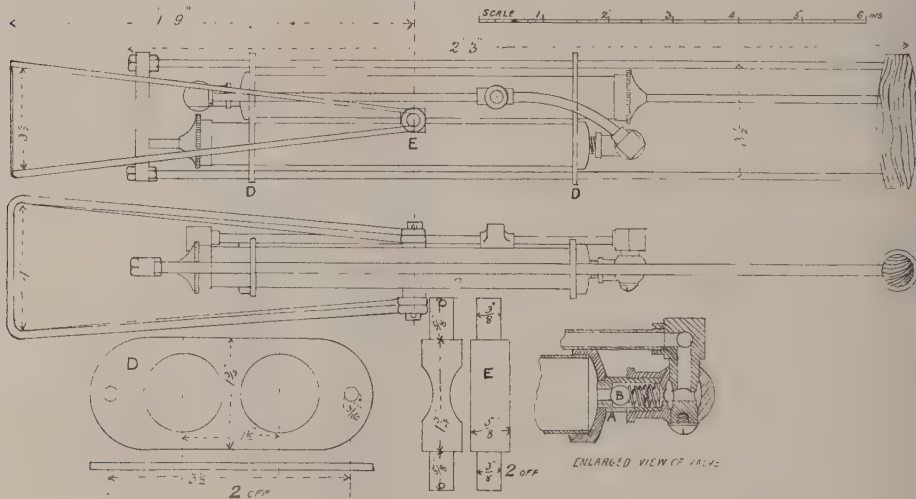
DOUBLE-ACTING AIR PUMP IN USE.

The next thing to receive attention is the delivery valves and their connections, for which are required two ordinary $\frac{1}{4}$ -in. Universal gas joints; also two brass nipples, $\frac{1}{4}$ -in. gas, reduced at one end to $\frac{1}{8}$ in. gas, bored out to $\frac{3}{8}$ in. at one end and $\frac{1}{4}$ in. at the other. Now procure two ordinary cycle-bearing balls to act as valves, 5 16ths in. diameter, as shown in the drawing marked B. Now make two small brass springs from fine brass wire, making the same taper 7-16ths in. at the large end, and $\frac{1}{4}$ in. at the small end, and just the right length to keep the ball firmly on to its seat. The delivery valves are now complete and ready for assembling in their respective positions.

The brass plates D should next be made by cutting out two pieces of sheet brass to the size of the drawing and solder them both together; then mark out the four holes

and drill the two outside ones $\frac{5}{16}$ in. diameter, the two centre holes to be bored just large enough to slip over barrel of pump; then file up outside edges of plates and unsolder same, ready for putting in their places.

Now get a piece of square brass about $\frac{3}{8}$ in. square and 3 ins. long, and turn down the ends to $\frac{3}{16}$ in. diameter, E; after which file out the circular parts in the centre and fit same nicely to the barrel of pumps when the two brass plates are in position. Two long steel rods should now be got, $\frac{1}{4}$ in. diameter and 2 ft. 3 ins. long, which should be very straight and screwed at both ends; slip these through the guide-holes in the brass plates, which should now be fixed in their proper position; then solder



DETAILS OF DOUBLE-ACTING AIR PUMP.

the brass plates nicely to the barrels, after which securely solder the gudgeon in its proper position, about the centre of the barrels. The bottom crosshead should now be made, being careful to drill and tap the centre hole to suit the screwed end of the pump which the wood handle previously occupied.

A new, hardwood handle should now be made, drilling all the holes so that the rods will screw tight into them. whole pump can now be put together and the connecting-pipe and T-piece made to connect the two delivery valves together.

The stirrup or stand can now be made out of some $\frac{1}{4}$ in. round iron, bending them to the shape shown, then passing loops over the turned ends of the gudgeon, and fasten same by drilling a pin-hole through each end of gudgeon. The bottom of the stand can now be fastened with small staples to a base-board or tied about 4 ins. apart with two strips of hoop iron bent over each end to clip the bottom of the wire stand and form a firm hold for the foot.

The above pump was made specially for working a small self acting steam hammer, and has been very useful in many other ways, giving a steady supply of air at a good pressure. It forms an excellent means of trying models during the course of construction, entirely dispensing with the trouble of attending to a boiler for that purpose.

A New Oil Engine.

THE following particulars of a new oil engine are given in a recent issue of *Hobbies*. The engine is the invention of Mr. C. H. Bryant, of Chiswick, who has discovered that when ordinary heavy petroleum oil of high flash-point is used to charge a column of air, and that air is compressed with a column of pure air, ignition takes place at low temperature and compression, and the explosion is much slower than usual, expansion continuing to the end of the piston's stroke. The motor built on this theory has the ordinary water-jacketed cylinder and piston, with

a novel form of combustion chamber. The piston is started by placing a lamp under the mixing chamber for a few moments, after which the engine becomes self-firing. So low is the temperature that the water jacket is really unnecessary. A single cylinder engine, developing three-horse-power when running at 450 revolutions, is only 1 ft. square on the floor and 3 ft. high, and weighs somewhat less than 300 lb. The compression does not exceed 60 lb. per square inch, the greatest working pressure reaching 220 lb.

UNDER the title of *The Light Railway and Tramway Journal and Rolling Stock Record*, a new monthly journal has been founded for those interested in the installation and working of tramways and light traction plant. This is a field which, though already large, is on the eve of an enormous development, and we imagine the new journalistic arrival will find ample room for accomplishing good and useful work. The first number is turned out in excellent style, and affords strong evidence as to the skill and enterprise with which this venture is being conducted. If any of our readers are connected with tramway or light railway undertakings, they will find this journal of much interest and assistance. The annual subscription is 10s., and the publishing address is 16, Eldon Street, London, E.C. Single copies may be had, price 1s. each.

Our Beginners' Page.

How to Start a Workshop.

By "ATLAS."

(Continued from page 171.)

THE vice having been procured, and fixed to the bench as directed in my last article, it should be fitted with two pairs of "clams," one pair being made of sheet brass or copper, and the other of lead. Of course, to cut out and bend these clams into shape means the use of some of the tools which I have not yet mentioned, and which, presumably, the reader has not yet procured. The making of these articles may, therefore, be postponed until the necessary tools are acquired, but I think it well to describe them now, for they obviously belong to this portion of my subject. These clams are of the shape shown in Fig. 3, and are intended to fit over the jaws of the vice for use when it is necessary to hold anything with a polished or finished surface, which the sharp teeth of the uncovered vice-jaw would otherwise scratch or bruise.

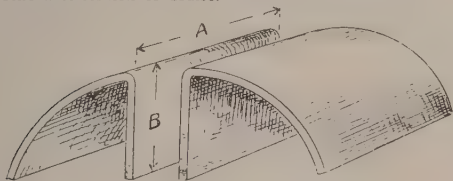


FIG. 3.—PAIR OF VICE-CLAMS.

The clams should be made of such a size as just fit the jaws of the vice, the length, A, and the depth, B (Fig. 3) corresponding with the inner face of the vice-jaws. The curved portions of the "clams," with rest on the outer portion of the vice, need be of no definite size, provided they are sufficiently large to form a proper support to hold the clams in place without falling off when the vice is open. To make the brass or copper clams, two pieces of sheet metal should be cut out, either with a hammer and cold chisel, or with a pair of strong shears, the width of each being that of the vice jaws, and the length about twice the depth of the vice-jaw, or rather more. The thickness of the metal should be about 1-16th in. Then take one of the pieces, and place it between the vice, so that it is level with the sides and bottom edge of the jaw. Tighten up the vice, and hammer over the projecting portion of the sheet metal until it beds nicely over the outer portion of the jaw. Do the same with the other piece of metal over the opposite jaw, and the pair of clams will be complete and ready for use. The lead clams may be made in exactly the same way, but the thickness should be about three or four times as great. If preferred, however, the lead may be first melted and cast into two L shaped pieces, which can afterwards be placed in the vice-jaws, and hammered over to fit.

HAND TOOLS REQUIRED.

The principal tools required are as follows:—Hammers, chipping or "cold" chisels, files, stocks and dies, taps, screw-plate, drills and drill stock, soldering iron, steel rule, calipers, centre punch, compasses, square, scriber, pliers, grindstone, adjustable spanner, screwdrivers, hand vice, cutting pliers or small shears, and hack-saw. The most suitable types and sizes of these tools can best be dealt with under separate headings as follows:

HAMMERS.

The reader who is making his first acquaintance with

tools may be surprised to learn that merely to illustrate the various types of hammers in use among metal workers would occupy several pages of this journal; but he will be reassured when I inform him that his requirements will be amply served, for a long while at any rate, if he obtains but two hammers of the type shown in Fig. 4, which, as well as the chipping chisels shown at Fig. 6, is taken from the excellent catalogue of Messrs. R. Melhuish & Sons, 84, 85, and 87, Fetter Lane, E.C. This is known as an engineer's ball-pane hammer, and the various sizes are classed according to weight. A good size for the amateur's workshop is one with a head weighing 1½ lb., the cost of which, including the handle, will be from 1s. 6d. to 1s. 9d. This will be suitable for the ordinary work of chipping, straightening, driving, rivetting, &c., but it will be found extremely useful for

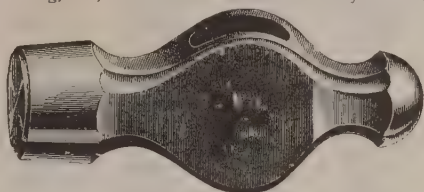


FIG. 4.—ENGINEER'S BALL PANE HAMMER.

very light work to have a much smaller hammer of a similar type, costing about 1s. 2d. The "ball-pane," or small round knob at the back of the hammer head, is chiefly used for rivetting. Care should be taken to choose a handle which feels comfortable to the hand, as this may make a difference in the quality of the work done.

CHIPPING CHISELS.

Chipping chisels, or "cold" chisels as they are sometimes termed, are used for many different purposes, such as removing the outer skin or rough projections from the surface of a casting, cutting out slots and keyways, cutting off pieces of rod and sheet-metal, and, generally, for roughly shaping pieces of work prior to the application of a file or other finishing tool. A "flat" chisel is one with

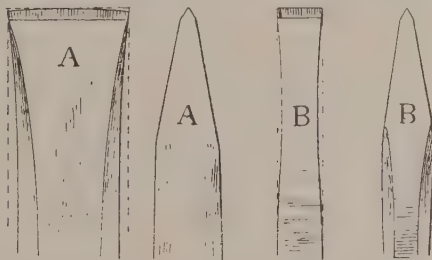


FIG. 5.—TYPES OF CHIPPING CHISELS.

a broad, straight, cutting edge, as shown at A, Fig. 5, and is used for chipping over flat surfaces and for cutting off pieces of metal. Strictly speaking, the cutting edge of a flat chisel should not be perfectly straight, but should be very slightly rounding, as shown at A in Fig. 5. This permits it to enter the work more smoothly, and enables a better surface to be produced. The angle of a chipping chisel at the point should not be so sharp for cast iron as for wrought-iron or steel, although the exact cutting angle is not a matter of great importance, provided the chisel is found to cut fairly well. A chipping chisel should not be too hard or it will break under the heavy blows to which it is frequently subjected. If it is hardened and tempered to a deep straw or plum colour, it will be found to be

about right. A "cross-cut" chisel (B, Fig. 5) is used for cutting out slots, keyways, and narrow grooves. Where a wide surface of metal has to be chipped over, a cross-cut chisel is used to chip a series of grooves or channels across the surface, the intervening metal being afterwards removed by chipping with a flat chisel. The widest part of a chisel should be at its cutting edge, behind which point a clearance taper, as shown in Fig. 5, should be given. This is particularly necessary with cross-cut chisels with which deep cuts have frequently to be made.



FIG. 6.—CHIPPING CHISELS.

The chisel shown at C, Fig. 6, is a diamond-pointed chisel, which is useful for clearing out and cutting into corners, &c., while the one illustrated at D, Fig. 6, is a half round or round-nose chisel, which is occasionally of service. Both the C and D types of chisels are useful for drawing over holes to correct position when starting drilling. For a commencement I would advise the purchase of one flat chisel of fairly large size and two flat chisels, and two cross cut chisels of smaller sizes. There are some useful notes on making small chisels in THE MODEL ENGINEER for March, 1899, page 49, to which the reader should refer.

(To be continued.)

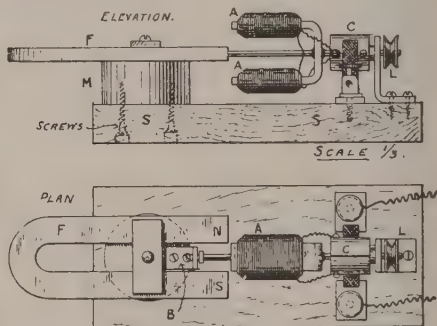
How to Make a Very Simple Electro-Motor.

By R. F. M. W.

THE motor here described is suitable for the younger readers of this paper, as it gives a good insight into motor principles in general, is very easy to construct, and runs well when carefully made. The field magnet F first demands our attention. It consists of a permanent steel magnet with parallel limbs—4 ins. long, $\frac{1}{2}$ in. between limbs, metal $\frac{1}{2}$ in. wide and $\frac{1}{4}$ in. thick. This can be obtained from any electrician's for about a shilling.

The armature A is made from a piece of soft iron about $4\frac{1}{2}$ ins. by $\frac{1}{2}$ in. by $\frac{1}{2}$ in. It is bent into horseshoe shape (the metal being heated to redness), with its limbs $1\frac{1}{4}$ in. long and $\frac{7}{8}$ in. apart; it should be left to cool by itself. A central hole is drilled in this magnet, and a $3\frac{1}{2}$ in. spindle cut from a true and straight No. 19 steel knitting-needle. This is soldered firmly and truly in the

armature, which should be well balanced. The spindle should protrude about $1\frac{1}{4}$ ins. on the commutator end C. Now a small collar of brass or copper is soldered on to the front end of the spindle, leaving about 3-32nds in. to enter the bearing. This bearing is the front bearing (B), and is made from a piece of brass $\frac{3}{4}$ in. by $\frac{5}{8}$ in. by 1-16th in., $\frac{1}{4}$ in. of this being bent sharply at right angles. (To bend brass and copper, the metal should be heated to a red heat and then quickly cooled in water, after which it will bend well and without breaking.) In the longer end two small holes are drilled for the holding down screws. The back bearing L is made from a piece of brass 2 in. by $\frac{5}{8}$ in. by 1-16th in. This is softened, and about $\frac{3}{4}$ in. is bent at right angles to the rest. The longest part may be tapered away towards the top, and neatly rounded. Two holes for holding down screws are drilled in the short end.



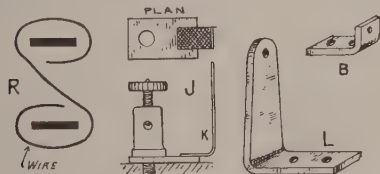
The stand S is made of a piece of well-seasoned wood, about 6 in. by $2\frac{1}{2}$ in. by $\frac{3}{4}$ in. This is well planed and sandpapered up, and then varnished or polished. The field-magnet saddle is then constructed, and may be either round or square; a good size is $1\frac{1}{4}$ in. square (or diameter) and $\frac{3}{4}$ in. high. The centre line of the stand is now carefully obtained, and the saddle is screwed down near one end of the stand. A piece of brass about $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. is cut out, and a hole drilled in its centre. The field-magnet should now be screwed down on its saddle by means of this brass plate and a screw, which is driven into the centre of the saddle. A hole has now to be drilled in the front-bearing B, at such a height that when this is screwed on to the saddle the field magnet and spindle will be in the same plane. The front bearing is then screwed down, and the back bearing L put face to face with it, so that its hole may be marked off and drilled in the right place.

Now comes the most difficult part, namely the commutator C. It consists of a brass tube, $\frac{5}{8}$ in. diameter and $\frac{3}{8}$ in. long, and about 1-16th in. thick. This is forced on to a circular piece of ebonite or boxwood, in which a hole is drilled to fit the spindle. Four short brass screws are screwed into the tube and ebonite, two at each opposite end of a diameter, one of each of these being countersunk level with the surface of the tube, and fixed smooth. Two saw cuts must be made at each end of a diameter, the diameter being at right angles to that of the screws. These saw cuts must be clean through the brass tube and a short way into the ebonite as well. The screws used to hold the two brass cheeks (just cut) on to the ebonite or boxwood must be short enough to quite clear the steel spindle. Such a commutator can be obtained for about 1s. 6d. from electrical dealers. It is troublesome to make, especially for those who do not possess a

lathe, and it should run quite true when on the spindle. Now force the commutator on to the spindle so as to clear the armature by about $\frac{1}{8}$ in. Twist it so that its cuts are at the top and the bottom when the armature limbs are at the top and bottom (see sketches).

The armature may now be mounted in its bearings. Place a small metal washer on the spindle between the commutator and the back bearing. Slide the back bearing on the base until only a small amount of end play is allowed to the armature, and screw the back bearing down to the stand with two brass screws. Adjust the field-magnet to clear the armature by about 1-32nd in. to 1-16th in. Take the armature and spindle out for winding.

The armature limbs must be covered with silk cloth or thin paper, so that not a bit of bare iron is left exposed. Commence winding by tying about 2 ins. of the wire (No. 26 D.C.C. or S.C.C. copper wire) to the commutator, and start winding along the limb, winding each wire close to its neighbour, and wind tight like a reel of cotton. When the end is getting near (say about half way) put a piece of silk, the same colour as the insulation of the wire, under the wire, and leave about an inch. Now wind on till you reach the end. Pull the silk up tight over the last wire, and wind back. Do this with every layer at each end. It prevents the under layers



slipping when the top ones are wound over them. Six layers must be got on each limb, making the total wire about 36 yards or 2 ozs. When crossing over to the second limb, wind the reverse way (see R) like an S. When both limbs are wound with the same number of layers (and turns as near as possible), the end of the winding must be firmly tied to the limb. Now cut off all the stray insulation which sticks to the unwound iron, and clean up. Test for leakage by cleaning one end of the winding and connecting any good cell to one end. Leave the other end of the winding free. Touch a wire from the other pole of the cell on to a piece of the iron which has been scraped clean. If in a dark room no spark is seen when contact is made with the iron, there will be no leak. Connect the cell through the winding and the armature should be a fairly powerful magnet. If it does not magnetise there is a short circuit or a wire broken, and the armature must be re-wound. Clean both ends of winding and twist them under the two commutator screws; then drive the screw home.

All that remains to be done is to put some terminals and brushes on the machine. Cut two copper or brass blocks (see J) about $\frac{5}{8}$ in. by $\frac{7}{8}$ in. by 1-16th in. or 1-32nd in. Drill a hole in each well towards one end to fit the tang of a binding screw. Cut two brushes of thin copper gauze about 1 $\frac{1}{2}$ in. by 3-16ths in., and solder them to these copper bits and bend them at right angles (K). Now place these blocks so that the brushes spring firmly on to the middle of the commutator; bore a hole for each binding screw, and screw them home. These brushes should only be one thickness of gauze, and should press firmly on to the commutator. The machine looks well with all the iron-work painted up one colour and the coils shellaced, varnished red or black (mix red lead or lampblack with S-varnish), and the saddle and

base varnished or polished. The motor will run very fast with one Leclanché or any cell on, and at a furious speed with two cells on in series—even a piece of carbon and zinc in salt and water will make it work well. The best cell for long runs is porous pot with carbon and a solution of water, potassium-bichromate and sulphuric acid; outer cell sheet zinc in salt and water. The writer has run his little machine for fifty four hours without a stop with one charge from the above cell, and at a speed somewhere near 2000 revolutions per minute. A small metal or wooden pulley may be keyed on to the shaft at L. The principle on which this motor acts is—“Similar magnetic poles repel, dissimilar poles attract.” The current is changed by the commutator always at such a time that the actions between the electro-magnet (armature) and permanent magnet (field) tend always to keep the former in motion. This little machine is not self-starting, and, of course, very little work can be got out of it.

The Editor's Page.

JUDGING by the very large number of queries which we receive relating to model locomotive building, this is a subject in which a keen and widespread interest is taken, and if every engine about which we have supplied information has actually been built, the number of model locomotives in the world has very greatly increased since the starting of THE MODEL ENGINEER. For once in a way, we propose to turn the tables on our readers, and ask them to set their wits to work over the proper proportions of a model locomotive, of which we will give a sufficiently general specification to enable every would-be designer to have an equal chance for the prize. For, we may here say, this is to be a prize competition.

We want to see how our readers shape at preparing a design of a locomotive of a given size, and, to encourage them to put on their thinking caps to some purpose, we will give a prize of £1 ts. for the best design for a model loco to fill the following requirements:—The model to be of main-line engine and tender, the engine to be powerful enough to pull a load equal to twice its own weight, on the level; the gauge to be $3\frac{1}{2}$ ins. The greatest width should not exceed 7 ins., and the greatest height should not exceed 10 ins. The fuel may be either coal, charcoal, spirit, or oil, at will of competitor, and the working pressure should not exceed 50 lb. per square inch. The boiler must be capable of maintaining steam for at least fifteen minutes without replenishing. The engine is to be fitted either with bogie or radial axles, so as to be capable of running round curves of 5 ft. radius. Provided the foregoing general conditions are complied with, the general design of the engine is left entirely to the competitor's own discretion.

It must be borne in mind that the design should show a model intended for good working qualities, and in making the award, preference will be given for the design, which, while being neat and well-proportioned in general appearance, shows at the same time the greatest simplicity and workmanlike character in the details of construction. Other points being equal, the prize will be

awarded to the sender of the neatest drawings. The drawings should be in good, black Indian ink on white cardboard, and no coloured lines or washes should be used. The leading dimensions should be neatly shown in figures, and the scale to which the drawings are made should be stated. The views shown should include a complete side elevation and plan of the engine and tender, and end elevations showing front of the engine and interior of cab respectively. Detailed drawings of boiler, motion-work, lamp, &c., should be shown on a separate sheet if necessary. Each competitor should send a short description of, say, about five hundred words, pointing out the leading features and advantages of his design. Competitions should bear the full name and address of the sender on all the sheets, and should be addressed to the Editor, "THE MODEL ENGINEER," 6, Farringdon Avenue, London, E.C. The last day for sending in is November 30th.

Our readers will note that in the foregoing competition we have chosen the gauge of $3\frac{1}{2}$ ins., which, it will be remembered, was adopted by the Society of Model Engineers as their standard gauge for the smaller scale models. We are aware that we have set our model locomotive friends a not too easy task, but at the same time we believe that there are many of them who are capable of turning out a really good design, and we hope they will all have a good try for the honour of gaining the prize. If the competing designs are of sufficient merit, we shall probably publish a selection from them in these pages in due course, and some interesting comparisons will then be able to be made.

We have received a sealed envelope from a reader in India, who has evidently omitted to enclose the letter he intended sending therein. The envelope is addressed to the Editor, and bears a one anna stamp, with the postmark "F. 78, J. 19." Will the sender kindly forward the missing communication, which shall then have our attention?

Readers who have models suitable for exhibition may like to know that an "Art and Industrial Exhibition" is to be held at the Peterborough School of Science and Art, at the end of September. The secretary of the Industrial Section is Mr. Alf. Turner, to whom enquiries should be addressed at the School. We may mention that the committee guarantee the safe keeping and return of any models committed to their care.

The article descriptive of Colonel Hamilton's model railway, which appears elsewhere in this issue, forms No. 1 of a series, in which we intend to deal with the various miniature railways which may come within our notice. We already have several further railways in view for description in future issues, but we have no doubt there are many readers who have model locomotives and permanent way which would be worthy of a place in our columns. We shall, therefore, be pleased to hear from those who have carried out work of this kind, and who are agreeable to place particulars and photographs of their railways at our disposal.

Practical Letters from Our Readers.

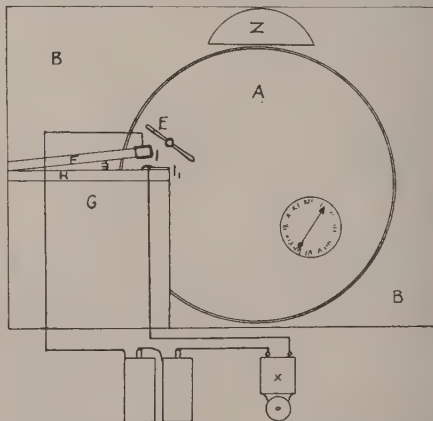
[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.]

Electric Clock Alarm.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Seeing a little while ago that there were a few articles on the different types of electric clock alarms, I beg to submit the following, which I hope will be beneficial to the readers of *THE MODEL ENGINEER*:

The alarm attachment is very simple; a lad of 10 could fit up the whole thing. A is the back of an ordinary alarm clock (all works not shown) fixed in a wooden case B; E is the winder for the ordinary alarm. Having wound this up, fix block G with a layer of insulating material on the top surface, and by means of a hinge fix a piece of wood F, the shape shown in illustration. At the end of F fix terminal I, which runs right through F, so that when F is pressed down it will make contact with the terminal P, which is fixed on G. A small spring must be fixed under



F, as shown, to keep F in required position. Having set your alarm in the ordinary way, when the time comes round it will ring the ordinary alarm bell Z. When the spring unwinds it will cause E to revolve; when it touches F it will press it down on G and cause the electric bell X to ring by closing the circuit. Therefore, X will not leave off ringing until E is turned half-a-round and F released; or the current must be switched off. Either way it will make you "turn out," unless sleep can still be claimed with a loud bell ringing in the room. A back (wood) may be fitted to the case B, and the wires lead through the sides, the batteries placed out of sight, and the bell in any convenient place. Then this ought to make a very neat, sound job.—Yours truly,

Redhill.

F. H. B.

Preserving Tools from Rust.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The following method of keeping tools bright and free from rust may be of interest to many of your readers who are similarly situated as myself.

I am generally away about six months in the summer. To preserve my tools from rust during this time—my

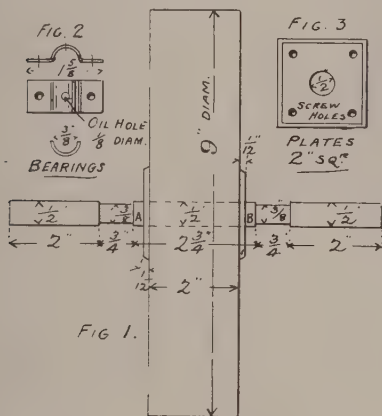
workshop being rather damp—I give them a good coating of vaseline, and place in tanks and cover with paraffin. This is not so expensive as one would expect, as the paraffin is afterwards used in lamps, the only waste being about a gallon of gritty stuff at the bottom of tank. Tools with handles are covered with vaseline, and hung so that metal parts clear everything, and they keep bright, although one or two things I have left without vaseline have become as rusty as horseshoes. As a rule, I find it necessary to keep vaseline on all my bright tools, owing to sudden changes of temperature caused by my blow-lamps, which will often produce condensation on the tools, but the moisture does not penetrate the vaseline to any great extent.—Yours truly,
J. W. C.
Polegate, Sussex.

A Simple Water Motor.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I have pleasure in enclosing you a note of some alterations I made when constructing the water motor described by J. P. F., of Leigh, Lancashire, in the February issue of this year, and which I think improves the running of same.

Axle.—To make a rest for the axle and keep the drum from rocking about, I got recesses turned where the axle touched the wood (see A and B, Fig. 1), which



made two collars at A and B. Of course the grooves can only be made if the axle is solid, as when the axle is made out of a tube it will not stand cutting.

Drum.—To keep the drum in its place on the axle instead of keying same on, I got two pieces of sheet iron, 2 ins. square, in the centre of which I bored a hole $\frac{1}{4}$ in. diam., so as to be a tight fit, and in each corner bored holes to suit $\frac{1}{4}$ -in. countersunk screws. After having bevelled the corners of the plates, I brazed one of them 1 in. from the centre, then having fixed the drum tightly against this plate, I fixed the other plate on, which kept the drum firmly in position.

Bearings.—I made simple bearings by merely sinking half the diameter of the axle into the sides of the box and screwing a piece of $\frac{3}{8}$ -in. inside diameter brass tube into the recess. For top covers I used a piece of brass plate and bent it to section as shown in Fig. 2. To keep the covers of the axle a little, I placed a small piece of sheet brass under the screw holes.

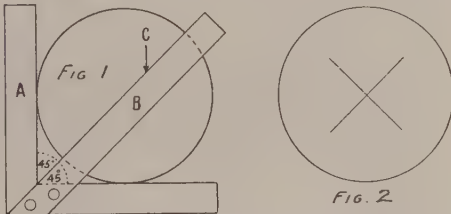
Water Cone.—I think it gives much better results if this pipe is placed on the top cover so as to get the force

of water running downwards instead of horizontally.—
Yours truly,
S. S. L.,
Edinburgh.

How to Centre Work for the Lathe.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I notice in your June issue an article, "How to Centre Work for the Lathe," by "Atlas." Perhaps the following simple but useful apparatus may interest some of your readers. A is a square about $\frac{1}{4}$ in. thick, B is a thin blade rivetted on to A, such that the edge C is just dividing the right angle into two equal angles of 45 degs. each.



In using it, put it on to the shaft as shown in Fig. 1; scribe along edge C; turn the square about quarter of a turn; scribe again, and the end of the shaft will have the appearance shown in Fig. 2. The intersection is the centre of the shaft.—Yours truly,
VAJ,
Copenhagen.

Old Electric Lamps.

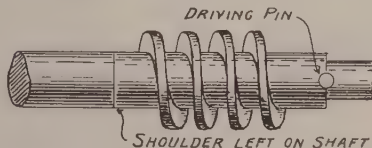
TO THE EDITOR OF *The Model Engineer*.

SIR,—For amateur electricians who find that their electric lamps (incandescents) are of no further use when any or both loops get broken, I may say I have adopted the simple plan of soldering the ends together again with a clean pointed copper bolt well tinned at the point. If the loop terminals are completely broken off, a piece of lacing wire can be attached in this manner. Any thin tinned wire will do, instead of the lacing wire which is kept by electrical dealers.—Yours truly,
D. Y.,
Paisley.

Model Electric Motor-Car.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Whilst thanking your valued contributor, Mr. Rooke, for his kind expression of appreciation with respect to the design of the motor used in his model electric



motor car, may I offer a hint as to what I consider a better mode of attaching the worm to the armature shaft than by means of solder? Leave a shoulder on the shaft for the worm to butt against, and drill a hole at the other end whose centre is distant from the shoulder exactly the length of the body of the worm; then, with a fine "rat-tail" file, form a groove across the end of the latter, so that a small taper pin, driven in tightly, will both hold and drive the worm in a proper mechanical manner.—
Faithfully yours,
ALF. H. AVERY.
Fulmen Works, Tunbridge Wells.

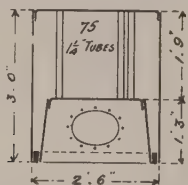
Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should be invariably enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.]

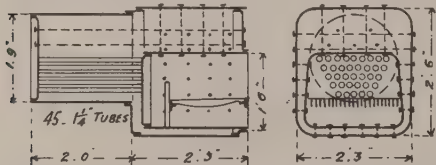
The following are answered from the queries which have been replied to recently:—

[1215] **Radial Valve Gears, Boilers, &c.** S. A. A. (Leighton Buzzard) writes: I write to ask if you would insert a query relative to radial valve gear suitable for a launch engine, same to be worked by one eccentric and reversed by a lever. (2) At the same time may I ask you to insert a simple formulae for finding size of boilers for engines up to 1 h.p., taking say the capacity of cylinder as basis? (3) What size cylinder would a vertical boiler suit 2 ft. 3 in. high, 1 ft. 10 in. dia., firebox 1 ft. 6 in. diam., 1 ft. high six 2 in. vertical tubes, exclusive of ash-pan and smoke-box? (4) A very rough sketch of a light boiler suitable for a 4 in. $\times$ 5 in. cylinder would oblige for a launch.

(1) A radial valve gear worked by one eccentric would only answer for a valve having no lap and lead unless some additional mechanism is employed. It would be necessary to place the eccentric at right angles to the crank for running in both directions, steam would be admitted for the whole stroke. (2) Walschaert's valve gear has one eccentric at right angles to the crank, and the movement for lap and lead is obtained from the crosshead, the valve being worked by a compound movement. In Joy's gear no eccentrics are used, the valve being worked by a compound movement obtained from the connecting rod. The link motion with two eccentrics would be as easy to fit up as either of the other gears, and if well designed and constructed, would absorb very little power. An unbalanced slide valve takes power to drive it and causes friction in the gear. (3) For small boilers working at pressures up to 50 lb. per square inch, about 150 sq. in. of heating surface will produce 1000 cubic in. of steam per minute. The size of boiler can be determined by finding the cubic inches of steam used by the engine, per minute by multiplying the area of piston by the distance it travels in inches before steam is cut off and by two for the two strokes in one revolution, and by the number of revolutions per



minute. For a one h.p. engine about 12 sq. ft. of heating surface and $1\frac{1}{2}$ sq. ft. of grate are allowed. (3) Cylinder $\frac{1}{2}$ -in. bore and 4 in. stroke. (4) Probably one of the well-known makes of water-tube



boiler would be the lightest form. A vertical boiler of large diameter in proportion to height with shallow firebox and large number of tubes is often used for steam launches, or a loco, type boiler with Belpaire firebox as sketched would be fairly light.

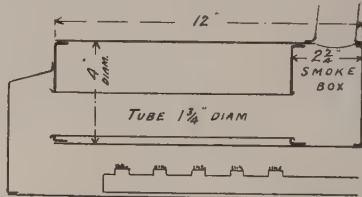
[1263] **Winding for Dynamo.** F. A. E. (Sheffield) writes:—Enclosed is a sketch of dynamo, and an armature stamping for same. Please state what amount and size of wire it will take for same. Also, what will be the probable output when shunt-wound?

Wind armature with No. 22 s.c.c. wire, in 8 sections, using about 10 ozs. Wind the field magnets with $\frac{1}{4}$ lb. No. 24 d.c.c. wire, and connect in shunt. If properly wound and connected, you should get an output of about 2 amperes at 24 volts, when running from 3000 to 4000 revs. per minute.

[1275] **$\frac{1}{2}$ -in. Spark Induction Coil.** A. F. G. (Stroud, Glos.) writes:—Would you kindly give me dimensions to make a $\frac{1}{2}$ -in. spark induction coil, and how many bichromate cells to use? For $\frac{1}{2}$ -in. spark coil, have core 6 in. long, $\frac{1}{4}$ in. diam.; bobbin, 6 in. long, 2 in. diam.; primary, 2 layers No. 20 s.c.c. wire; secondary, $\frac{1}{2}$ lb. No. 40; condenser, 40 sheets of tinfoil, 2 in. by 2 in.; battery, 2 or 3 pint bichromate cells.

[1292] **Furnace for Horizontal Boiler.** F. S. (Ilkeston) writes:—I have a horizontal boiler, 12 in. $\times$ 4 in., with a $\frac{1}{2}$ in. tube through it. In this I placed a lamp with eight lights, and using $\frac{1}{2}$ -in. tube, but I found it immediately went out. Will you kindly tell me how to remedy it? Also, will you tell me what to apply to sheet iron before painting to make it look glossy and smooth?

It is very doubtful if even one light would keep burning in a $\frac{1}{2}$ -in. tube, 12 in. long, much less eight. If you can induce a considerable draught through the tube (by the addition of a good tall chimney, with a steam blast of possible), you need get the burners to keep alight. The form of the boiler is, however, a very ineffective type. The through tube might be $\frac{1}{2}$ in. diam., with a better result; but we should not like to guarantee it. Either the 4-in. tube should be made into a loco, type boiler, with 3 in. tubes, or it should be externally fired with a return tube not less than $\frac{1}{2}$ in. diam. to uptake. Thus:



To get the best surface, simply clean up well with emery cloth, remove all traces of grease, and give two coats (using a soft brush) of enamel, such as Maurice's Porcelaine, allowing first coat to thoroughly dry before putting on the second. The enamel is best when the article is dried off in a warm oven for a few hours.

[1216] **Gramophone.** J. T. (Glasgow) writes: Can you assist me in making a gramophone (up to date)? Where can I get drawings or a book dealing with the above?

A series of illustrated articles on the gramophone has lately been published in the *English Mechanic*, with illustrations.

[1220] **Overtype Dynamo.** F. B. J. (Peckham) writes: Enclosed please find drawings of model dynamo. (1) Will you please tell me the size and quantity of wire I am to wind it with to get the best results? I want to wind round the armature so as to have a 4-section commutator. Would the dynamo charge two 4-volt pocket accumulators in series? What would be the output—about? What speed should it run at? (2) What ought to be the dimensions of cylinder and flywheel of steam engine to work the dynamo in my first query? Would a boiler (rubular), 4 in. by 7 in., with a tube 2 in. by 6 in. for a firebox, and the heating being gas, drive the above engine? (3) What ought to be the dimensions of cylinder of gas engine to drive the dynamo in my first query?

(1) You would do better to wind in eight sections (four being wound on top of first four), and you would not find an eight-part commutator more difficult to make than a four-part one. After dressing all parts touched by the wire with thin silk tape and shellac varnish, wind armature with No. 24 s.c.c. wire, getting on about 3 to 4 ozs. Field-magnets must be wound with $1\frac{1}{4}$ lb. No. 22 d.c.c. wire, and connected in shunt. With the dynamo charge two would give an output at 4000 revolutions of 10 to 12 volts, and one ampere. The dynamo would be suitable for charging two 4-volt accumulators in series without a resistance in circuit. (2) An engine with steam cylinder, 1 in bore by $\frac{1}{2}$ in. stroke; flywheel, 6 in. diam.; steam pressure, 40 lb., would probably drive the dynamo easily; but the boiler you suggest would not suffice to supply necessary amount of steam. (3) With a gas engine the power of models varies so much that nothing definite can be given. A good one, with cylinder 1-in. bore by 2 in. stroke, ought to drive the dynamo.

[1230] **Tramcar Motor.** O. A. P. (Brixton) writes: With reference to "A Model Electric Tramcar Motor," by Mr. A. H. Avery, A.Inst.E.E., in your paper kindly tell me—(1) What is meant by fibre disc, sheet, etc. (on page 66, No. 15, first edition). What is it, and how could I get it? (2) I should not the size be $\frac{1}{4}$ in. diam., $\frac{1}{4}$ in. thick, instead of $\frac{3}{4}$ in. thick as printed. (3) Would the bichromate battery described in No. 1, Vol. 1, page 9, drive the motor; if so, how many cells should I require? (4) Could this motor be run as a dynamo.

(1) The "fibre" is the well-known "vulcanised fibre" in common use by electricians for insulation. You can get it of any dealer in electrical sundries, such as Messrs. Whitney, or other advertisers in THE MODEL ENGINEER. (2) Yes, the $\frac{1}{4}$ in. is a printer's error; it should have been $\frac{1}{2}$ in. (3) The cells are rather small for the motor, and would polarize quickly if you use only three (three are

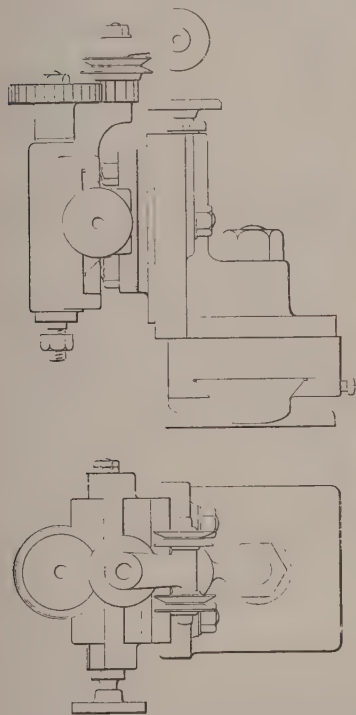
necessary to provide the EMF—6 volts—required). The best plan would be to have three cells of twice the size, or to use six of the small cells coupled in two sets of three cells each. (4) No, the motor is designed for a special use as a motor, and is not suited to run as a dynamo.

Amateurs' Supplies.

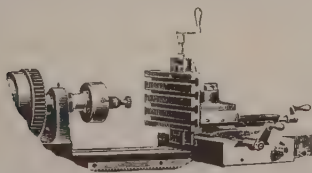
[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.]

Vertical Gear Cutting Attachment for the Lathe.

A very useful adjunct to the lathe is the vertical gear cutting attachment made by the Britannia Company. This apparatus is



suitable for fluting taps, milling keyways in shafts, spiral fluting and cutting spur, bevel, or worm gearing. As may be seen by reference to the above illustration, which shows an elevation and plan of the appliance, it is provided with both vertical and horizontal adjust-

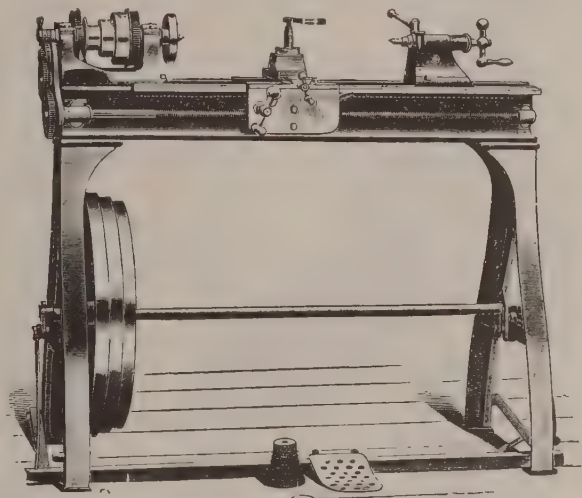


ments, and the milling spindle can also be set to work either in a horizontal or vertical position or at any angle between those positions. Wheels with any number of teeth can be accurately cut with the combination of a division plate on headstock of lathe, and many other uses will be found by the amateur or professional worker for the apparatus. Another useful appliance by the same firm is illustrated above. This is a vertical slide rest which can be attached to the ordinary

slide rest, taking the place of the tool holder. The vertical rest is provided with a vertical adjustment, the horizontal and transverse movements being obtained by the ordinary slide rest. Slots are provided for bolting the work to the face of the slide, and all kinds of milling work can be fixed with very little trouble. Those in search of such apparatus should write for prices to the Britannia Company, Colchester.

A New Screw-Cutting Lathe.

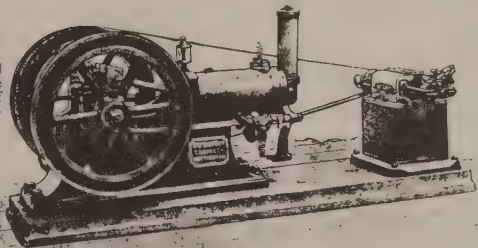
We recently inspected a newly designed screw-cutting foot lathe introduced by Messrs. C. W. Burton, Griffiths & Co., Ludgate Square, Ludgate Hill, E.C., and were struck with its many good qualities. The lathe, of which we present an illustration below, is well and strongly made, and appears to be well suited to high-class amateur and general model work, and is made in two sizes. The price, which includes compound slide rest, and screw-cutting gears, is moderate, and additional parts, chucks, countershaft, etc., can also be had at most reasonable terms. Readers on the look-out for



such a tool will do well to send for particulars, at the same time mentioning **THE MODEL ENGINEER**.

Combined Gas Engine and Dynamo.

We illustrate below one of Mr. H. E. Warsop's $\frac{1}{2}$ h.p. improved gas engines driving a 46.c.p. dynamo. This will be of interest to amateurs from the fact that these efficient machines can be obtained in any degree of finish, from the rough castings to the finished state. It is further stated that either engine or dynamo can be had

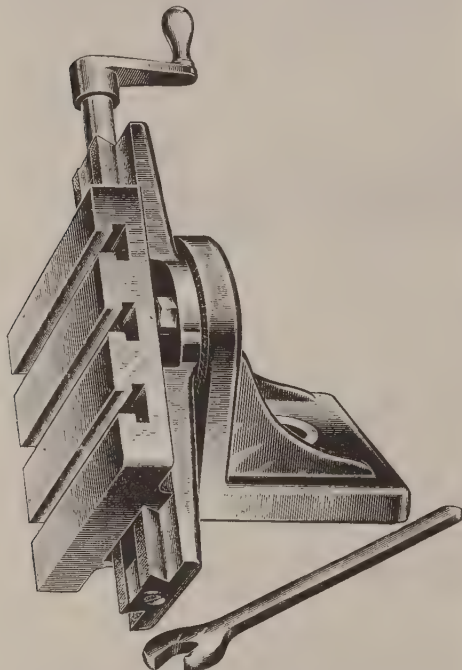


separately, whilst if bought together the two are mounted on one cast-iron bed, the dynamo being adjustable to allow of tightening the belt. For those investing in the rough parts, a scale of charges for machine work on various parts has been prepared, which will help the amateur over any difficult piece of work. The engines appear to be efficient and well designed, and as the cylinder and bed are cast in one piece great rigidity is ensured. If required, as for

dynamo driving, two flywheels are fitted, as well as a centrifugal ball type governor. Those requiring a small electric light plant would do well to write to Mr. H. E. Warsop, Launder Street Engineering Works, Nottingham, for his new list, and any further particulars they may require.

An Improved Vertical Slide.

Messrs. F. & H. Shaw send us particulars of their improved vertical slide attachment for bolting on to the top slide or slide rest for use in milling. The important feature of this useful appliance consists in the introduction of a swivel between the angle bracket and the slide, which renders it possible to get an angular movement of



the work or tools mounted upon the slotted plate. The value of the vertical attachment is very much enhanced by this improvement, which is clearly shown in the adjoining illustration, as there is now no position within the capacity of the lathe which cannot be given to the tool or the work when the swivelling plate is used in connection with the compound slide rest. Further information and prices can be obtained by readers from Messrs. F. & H. Shaw, Ltd., Hebbden Bridge.

Practical Instruction for Amateur Mechanics.

Model making enthusiasts would do well to make themselves perfect in their art, by getting competent instruction from practical men. It is to this end that the Finsbury School of Practical Amateur Mechanics has been instituted, and under the principalship of Mr. Thos. J. Sver, those who attend may rest assured they will get good value for money. A new term will commence in October, but although it is best to join at the commencement of a term, students can be admitted at all times. The workshops are thoroughly well fitted up for the purpose, and competent instructors attached to each class of work. The classes comprise cabinet work and carpentry, wood-carving and engraving, wood turning, and metal work, whilst others will be formed to suit pupils. Full particulars can be obtained on application to the Principal, Mr. Thos. J. Sver, 45, Wilson Street, Finsbury Square, E.C.

Catalogues Received.

Ardwick Engineering Co., Manchester.—List D, which reaches us from the Ardwick Engineering Co., contains particulars of a line of strong well-made copper boilers of varying sizes. These are all fitted with safety valves, water gauges, main steam valves, blow-off and pump connections, and an improved automatic blower

can be fitted at a moderate extra charge. This blower has an attachment, by which means the heat is regulated, so that when the safety valve blows off the heat is slackened and the steam kept as nearly as possible at one pressure. The most suitable size of engine is quoted for each boiler, so that readers who have constructed a model engine can see at a glance the size of boiler they should order to work it. **THE MODEL ENGINEER** should be mentioned when writing for this list.

F. & H. Shaw, Limited, Hebbden Bridge.—Additional sheets, containing prices and full particulars of some of Messrs. Shaw's latest specialties, are to hand, and show that customers are well satisfied with the goods. Castings and forgings of independent four-jaw chucks form an important feature; also surface plates in great variety, either in the rough, planed over, or truly finished. U.S. lathes for grinding, polishing, buffing, or scratch-buffing are listed, and these also can be obtained in the rough or finished. Messrs. Shaw claim that all their castings are made in a tough quality iron, free from sand or blowholes. Customers should write for quotations, mentioning **THE MODEL ENGINEER**.

Tyneside Supply Company, 2, St. Nicholas Buildings, Newcastle-on-Tyne.—This list should appeal to those readers requiring simple telephone installations at reasonable cost. The great advantages claimed for this system is the fact that any existing electric bell system can be adapted to the telephone arrangement without defacing the walls or paperhangings, by simply changing the old pushes for new pushes with metal tubes to receive pin connectors. The "P.H.C." loud-speaking micro-telephone sets are made up to suit various requirements, such as the "Office" set, "Private" set, or "Hotel" set, and can be had suitable for desk or wall stations. The firm also supply the "P.H.C." "Galvanophor" dry cells. The list will be sent free to readers of this paper.

Elbridge Electrical Manufacturing Company, Elbridge, N.Y., U.S.A.—A number of smart little circulars from "over the water" show some clever electrical novelties. The first of these is a model transformer, which is an excellent reproduction of its commercial prototype. This can be used either as a "step-up" or "step-down" transformer, and it is specially intended to work with a primary current of 15 volts. A small alternating current dynamo (No. 2 pattern) is another speciality, and this is designed to work with the model transformer described. Model arc lamps and various types of motors and dynamos also find places in these lists, which those interested will do well to apply for.

William Evans & Co., 20, Beaufort Road, Edglaston, Birmingham.—Readers in the cycle trade, and many others in allied professions, will find the list of gas enamelling ovens issued by the above firm, of considerable interest. The makers are also the possessors of a cheap and good cycle enamelling process, which appears to have been largely adopted in the trade. **THE MODEL ENGINEER** should be mentioned in writing for particulars.

F. H. Burrage & Co., Engineers, Redhill, Surrey.—Acetylene gas is making rapid headway now, and those who want to be well up-to-date in lighting up shops, factories, workshops, or houses should send to this firm for their list of generators and apparatus. These acetylene generators are made for various special and general purposes, such, for example, as photography, both in the studio and dark room. **MODEL ENGINEER** readers are recommended to make further enquiries of the firm.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to **THE EDITOR, "The Model Engineer,"** 6, Farringdon Avenue, London, E.C.

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PUBLISHED
MONTHLY.

The A.B.C. of Dynamo Design.

By ALFRED H. AVERY, A.Inst.E.E.

(Continued from page 144.)

CHAPTER IV.

HAVING disposed of theoretical considerations more or less fully, the student should now be able to turn his knowledge to useful account in the application of the foregoing principles to the more prac-

The armature is generally regarded as the starting point by the dynamo designer, and will, therefore, claim our first attention, the various types, windings, and modes of construction being duly reviewed.

Armatures are, or should be, invariably built up of thin laminations or core-discs of the finest charcoal iron sheet, not more than 1-32nd of an inch in thickness. The best quality of iron only is admissible for this purpose, and, after being stamped or cut into the form of the section of the finished armature, these core-discs are bolted, keyed, or otherwise secured on the shaft prepared for them.

There are various types of laminations, distinguished by

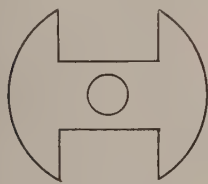


FIG. 24.



FIG. 25.

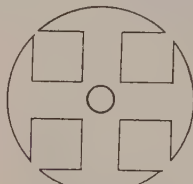


FIG. 26.



FIG. 27.



FIG. 28.



FIG. 29.

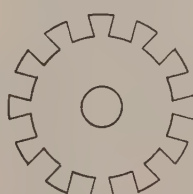


FIG. 30.

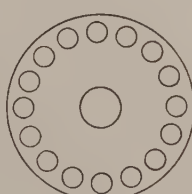


FIG. 31.

tical part of dynamo designing. And, to this end, it should be constantly borne in mind that the ultimate aim is to build a machine that shall properly fulfil its various electrical and mechanical functions with the least amount of material, the least labour in constructing, and the least waste; and if, by sacrificing a small advantage in one part, of the machine, it is found possible to effect a larger saving in another direction, it may be taken as good practice to abandon theory somewhat for the sake of the resulting gain in the average efficiency of the dynamo.

names that are more or less descriptive. The ones usually met with are:—The SIEMENS or “H” stamping (Fig. 24); the TRIPOLAR (Fig. 25), which may vary in form considerably, as also the QUADRIPOLE (Fig. 26) or “Walker” or “4-pole” stamping; the PLAIN RING (Fig. 27); the COGGED RING (Fig. 28); the PLAIN DRUM (Fig. 29); the COGGED DRUM (Fig. 30); and the TUNNEL (Fig. 31).

Another variety, sometimes mistakenly called the “Tunnel,” is shown in Fig. 32; but in reality this should

be classed among the cogged-drum armatures, for when the wire is not entirely enclosed and embedded in the iron of the core disc, it ceases to be a true "tunnel" armature.

There seems to be a prevailing uncertainty amongst most makers of small dynamos as to whether the core-discs should or should not be insulated from one another and the shaft. Not infrequently one comes across an armature built up with the laminations most carefully insulated electrically from one another, and then

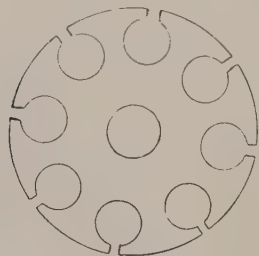


FIG. 32.

just as carefully short-circuited completely by being driven tightly on to a bright steel shaft, without a trace of insulating material between! Or, perhaps, the shaft will be properly insulated, and the core-discs, or bolting-up pins, left bare. Now, this is, to say the least of it, very inconsistent, and does not seem to indicate the maker clearly understands the why and wherefore. To reiterate a former statement, it is quite a needless refinement to attempt to insulate the core-discs of short armatures, and it makes it a very difficult matter to give them a proper drive from the shaft.

Various methods are in force for securing the core-discs to the armature shaft, and it is very important that a good mechanical job be made of this part of the work, or the discs will creep round on the shaft under the influence of the stresses and vibration encountered when the machine is at work. Armatures of the Siemens, tripolar, quadripolar, drum and tunnel patterns are by far the easiest to build up, since it is only necessary to assemble the core-discs direct on the shaft without the interposition of spiders or carriers, which is the case with all ring types. One of the best methods of driving extant, but unfortunately one of the most expensive also, is to employ a shaft of hexagon section and core-discs with centres of corresponding shape; by this means any tendency is avoided to springing the shaft out of true, which is liable to happen when keys or feathers are used. For the smallest armatures no keyway is necessary, provided shaft and core-discs fit well; but for anything exceeding 4 ins. or so in diameter it would be unsafe to dispense with a key, or some means of securing a positive drive.

If the shaft be of small diameter a shoulder can be left on at one end, and the core-discs clamped hard against it with a fine thread nut at the other; but if the shaft be of large section it will conduce to saving of material and labour to have a nut at either end of the core. In all cases where nuts are employed they must be guarded from running back, either by thin lock nuts, setscrews, or pins. All nuts should be carefully faced off square when in position on the shaft after tapping; otherwise springing of the shaft will most likely result when the core is pressed up. The best thread to use for such purposes is the ordinary gas thread for iron pipe; or for shafts under

$\frac{1}{4}$ in. diameter the brass gas thread. Whitworth pitch is altogether too coarse, cutting away too much metal in a vital part.

The usual practice is to provide end plates to the armature core of somewhat thicker material, in order to clamp the core with more even pressure all over. If the armature have a smooth core there is also need for driving horns to keep the conductors from creeping round when under the joint magnetic influence of the intense field in which they are rotating, and the field set up by the circulation of their own current. This is best carried out in the case of plain drum armatures by providing thick, vulcanised fibre end plates, previously slotted to receive driving horns of the same material. If the armature is a very long one, it is as well to have a set of driving horns in the middle also.

With ring armatures, it is, of course, not feasible to drive the core-discs direct from the shaft, and they are accordingly mounted on carriers or spiders of some non-magnetic material, with radiating arms, like a flywheel without any rim. The spiders are keyed or otherwise secured to the shaft, and the armature core attached thereto by means of bolting-up pins passing through both core-discs and spiders, and serving the double purpose of clamping and driving the core.

Occasionally, instead of the pins passing through the core-discs and spiders, a single carrier is used having thin arms extending the whole length of the core, and engaging in slots or keyways cut at intervals on its inner surface. This is, perhaps, the better construction of the two, as it leaves more room for wire, and there is a little less work in fitting. An illustration of this mode is given in FIG. 33.



FIG. 33.

The question of ventilation of armature cores sometimes crops up, and it will be as well to say a few words on this point in passing. Of course, no one would think of attempting to ventilate Siemens, tripolar, or quadripolar armatures, as these types are only used in the smallest diameters: all armatures of the ring type, too, are from their very construction naturally well ventilated. So the question resolves itself into the means or advisability of providing ventilation in drum or tunnel armatures.

The object of ventilation is to leave a clear passage right through from end to end of the core, enabling air to

circulate freely while the machine is at work, and so obviate any losses arising from heating of the conductors or core. These air passages generally take the form of deep keyways, or rather "airways"; or it may be that a series of apertures are stamped out in the body of the core-discs before assembling them on the shaft. Sometimes ring-type core-discs are mounted on a spider and the whole wound as a drum armature, with suitable openings in the end wire for the admission and egress of air; air outlets are often provided in addition at intervals along the surface of the core, communicating with the inner passages. In all ventilated armatures the windings must be so arranged as not to overlap and cover these outlets, or the purpose of their existence would be defeated. One rather ingenious device to secure a continuous flow of air worthy of note is the use of ring type core-discs mounted on a spider, the arms of which have a "pitch" like those of a fan or screw propeller; so that when running at a high speed air is forcibly drawn through the core from end to end.

With any one of these methods, however, it is evident that a considerable amount of work is required in excess of that which obtains with a simple plain core mounted direct on the shaft; and although theoretically ventilation is a good thing, it is very doubtful whether these advantages hold good in practice. For in a well-designed machine the heating effects in the armature core should be too insignificant to warrant such complication in structural detail as entailed by any system of armature ventilation.

(To be continued.)

The Junior Engineers at Portsmouth.

THE 1899 summer meeting of the Institution of Junior Engineers was held in the Portsmouth district from August 12th to 19th inclusive, and under favourable climatic conditions proved a splendid success. The party of members and friends, numbering about forty-five in all, left Waterloo in special saloon carriages by the 7.5 p.m. train on Friday the 12th, and reached their headquarters at Southsea the same evening. Saturday was devoted to a steamer trip round the Isle of Wight to freshen up the members prior to the heavy programme arranged for the following week. The real work commenced on the Monday with a visit to Portsmouth Dockyard under the guidance of Mr. John T. Corner, R.N. Chief Engineer, and Mr. J. A. Yates, Chief Constructor. This occupied the whole day with the exception of a pleasant interval at one o'clock when the party adjourned to the Portsmouth Town Hall where they were received by His Worship the Mayor of Portsmouth Alderman T. Scott-Foster, J.P., and entertained to light refreshments. At 9.30 in the evening the electrical members visited the Portsmouth Corporation Electricity Works where they were welcomed by Mr. E. Price, the superintendent engineer. On Tuesday morning the historic *Victory* was visited, the members being conveyed on board by a gunboat which subsequently took them for a run round the harbour to view the men-of-war at anchor. In the afternoon a trip was made to Cowes to inspect the works of the Liquid Fuel Engineering Company. By the kindness of the company some of the members were taken for a trip in a "Lifu" launch up the River Medina, while others had a ride inland on a motor-wagonette.

A special steamer provided by the Southampton, Isle of Wight, and South of England Royal Mail Steam Packet Company conveyed the members to Southampton

on Wednesday, where Mr. John Dixon, the marine superintendent of the L. & S.W. Railway, and Captain Lewis, the assistant marine superintendent, courteously received the visitors, and showed them round the docks wharves, quays, and engineering plant. At 1.30 p.m. the Mayor of Southampton held a reception in one of the dock buildings, and entertained the party to lunch. The inspection of the docks was completed in the afternoon, and the return journey to Southsea was then made, also by special steamer, kindly provided by the authorities. On Thursday morning the members went on board H.M.S. *Terrible*, and fully inspected all the numerous items of interest on this powerful vessel.

Friday was largely a day of pleasure, an excursion by road to Southampton via Netley Abbey taking place in the morning. In the afternoon the members visited the American liner, *St. Louis*, and afterwards returned to Portsmouth by train. In the evening the annual summer dinner of the Institution was held at the Esplanade Hotel, Southsea. On Saturday morning the week's meeting terminated, and the majority of the members returned to town. The greatest courtesy and kindness were everywhere experienced by the members, and everyone agreed that the week had been not only highly enjoyable, but



SIR WILLIAM WHITE, K.C.B., D.Sc., F.R.S.
(President of the Institution of Junior Engineers).

very instructive. At the dinner on Friday evening a handsome inkstand was presented to the secretary, Mr. Walter T. Dunn, as a mark of appreciation of the excellence of the week's arrangements, and of the indefatigable exertions on his part to secure the comfort and study the convenience of every member present.

The accompanying photograph is a capital portrait of the popular and distinguished president of the Institution for the current session, Sir William White, K.C.B., D.Sc., F.R.S., Assistant Controller and Director of Naval Construction. We are pleased to learn that for the ensuing session the Hon. C. A. Parsons, the inventor of the Parson's steam turbine, and the builder of the fastest vessel in the world, the *Turbinia*, has kindly consented to succeed Sir William White in the presidential chair.

FOR some weeks experiments of great interest in wireless telephony, as distinguished from Signor Marconi's wireless telegraphy, have been carried on near Carnarvon, by Sir William Henry Preece. Sir William has succeeded without other intermediary than the ether in transmitting the sound of a succession of taps. These taps were made with a view of sending messages by the Morse code. They were distinctly heard at the receiving station by placing the newly invented ethereal telephone to the ear. Messages have been sent without interruption for several days.

Heating Apparatus for an Amateur's Workshop.

By J. W. COOPER.

THE apparatus consists of hot water pipes, and stove or boiler heated by paraffin under compression. In my own case there is about 40 ft. of 1-in. iron water piping, including flow and return pipes to heat a lean-to room, built of quartering and boarded inside and

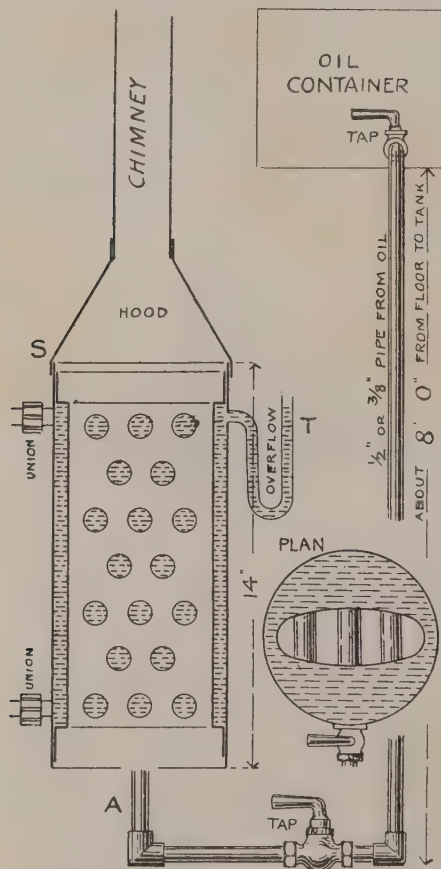


FIG. 1.

out with $\frac{5}{8}$ in. boards. The room is about 12 ft. by 8 ft. by 9 ft. high. The boiler (Fig. 1) is a modified form of Gallo-way pattern, about 14 in. high by 6 in. outside diameter. The outer shell may be $1\frac{1}{2}$ in. longer top and bottom. The furnace flue is soldered to two ends, which are soldered to outer shell. The flue is elliptical in section, and has $\frac{1}{2}$ in. or $\frac{3}{4}$ in. cross tubes, placed three and two alternately as shown on sketch, and about 1 in. from row to row. A chim-

ney hood fits on at S, and, if required, a pipe can be run through roof above chimney, which always keeps the room free from impure air. In my own case there is a ventilator, about 14 ins. by 12 ins., at the top of the wall on one side, which keeps the place well ventilated, but this has no connection with heating apparatus.

A syphon overflow of about 3-16ths in. diam. bore is fitted at top of boiler as shown at T, and another at top pipe where return commences at T₁ (see Fig. 2). A small water tank of zinc, about 8 ins. by 3 ins. by 3 ins., as shown (Fig. 2), prevents pipes getting empty. A small tap is placed at bottom of boiler, to draw off all water when required. The boiler is best made of copper, and can be soldered together; as it is always full of water, there is no pressure to hurt. The oil container may be of any convenient size or shape; the pipe is of brass, and would probably work if only 3-16ths in. or $\frac{1}{4}$ in. bore, but my own is $\frac{3}{8}$ in. The taps must be of best make, or will be certain to leak. The lower tap should be 18 ins. or 2 ft. from burner, or the heat will make it leak. The burner is of the "Primus" pattern, as used for cooking stoves, and burns about 5 gals. of oil per week of 168 hours. The nipple hole usually wants pricking out about once in twelve hours when using Royal Daylight or similar oils. It is desirable to place a tin—such as used for baking purposes—under the boiler and burner; these tins are stamped from solid metal, and run about 12 ins. by 12 ins., and 3 ins. deep, and prevent oil and water dripping on the

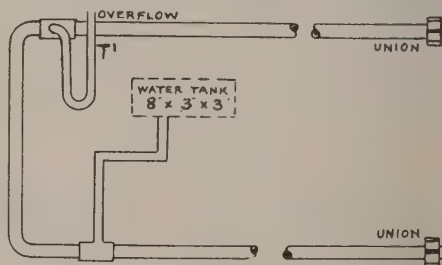


FIG. 2.

floor. It would also be well to have a shallow tray under oil container and tap. It is not necessary to have container 8 ft. high, as I have worked at 3 ft., or less, above burner, but with poor results.

To start, turn on the upper tap; fill the cup under burner, with methylated spirit, and when the spirit begins to boil, turn on lower tap, when the burner should work on for about twelve hours without attention, unless the oil is dirty, when it will be advisable to prick out the burner before that time, as the flames will be getting low. Sometimes it is advisable to place loosely packed asbestos at A at the bottom of burner to prevent a violent jumping motion of the flame, but generally it is not needed.

Before using this I had two fires by using ordinary wick lamps, but have had nothing wrong since I used this pattern. There is just one weak point, and that is if no strainer is used, the nipple may possibly get stopped up sufficiently to put the flame out. Then the oil filters down and makes a mess, but I have prevented that in my own case by making a tray of rather larger capacity than the container. I have only found the nipple stopped by using dirty oil.

The compression of paraffin is obtained by weight of oil in the pipe. Of course, gas would do much better, but we have no gas here. Any further information I would be glad to supply on the subject.

Liquid Fuel Burners for Model Boilers.

By "A MODEL STOKER."

THE greatest difficulty experienced in working a model locomotive or marine boiler on a scale of one inch to the foot or less, is to get a sufficiently intense heat in the firebox to obtain anything like proportionate steaming power. A lamp is most unsatisfactory, heating and overflowing, and by its size disfiguring the nice proportions of the model. Coal requires constant attention, and is apt to die out on so small a grate, chilled too by the water surrounding it. Kerosene oil has been found an almost ideal fuel when properly atomised, making an intense, smokeless white flame, requiring no attention when once adjusted. A burner, small and neat, which accomplishes this, and does not detract in the least from the appearance, is made as shown in Fig 3, brass being the material used. Steam is connected at D, oil at C, while tubing $\frac{1}{4}$ in.

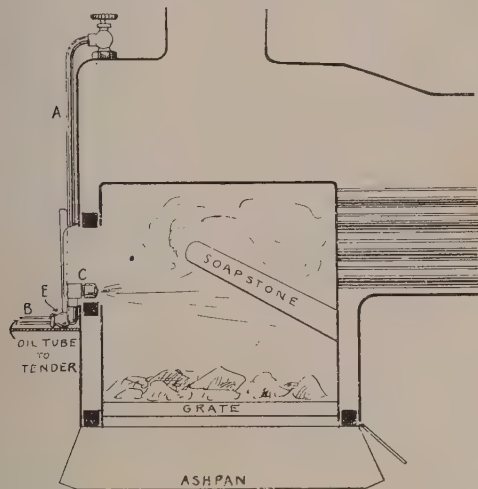


FIG. 1.

outside is ample. A small cock should be placed in each pipe. B is a cap which screws off and on to adjust. The steam opening at E should just admit the point of a fine cambric needle; the opening in B should be somewhat larger. F is a little screw-plug to admit of a fine wire to clear any stoppage. The cap B should be adjusted until the oil is atomised in a fine spray like dust. If too far out, it will throw a solid stream. The arrangement of the connections and position can be altered to suit various conditions. It will even lift the oil a few inches, in which case the stop-cock in the oil pipe is not required. Thus, in an English tender the oil tank can be below the floor and above the axles out of sight. As fitted to a successful model American locomotive, the arrangement is as shown in Figs. 1 and 2.

A soapstone arch is used, as shown, which scatters the jet and aids combustion. The fire-door fits over and conceals the atomiser.

A blower-jet with orifice about the same as the steam opening in atomiser is required in smokebox, and must be opened when the engine is stopped and in getting up

steam, otherwise the burner will smoke horribly and flame will come out at bottom of firebox, as there is, practically, no natural draught with $\frac{1}{2}$ in. flues. A fine wire gauze strainer should be fitted in oil-tank, which fits in coal space of tender. The oil-tank should be copper, as tin, for some reason, soon corrodes.

The process of getting up steam is as follows:

The grate should be covered with a layer of cinders, broken pumice-stone or chalk.

The blower-valve and steam and oil-cocks are opened.

A bicycle pump is coupled to the suction-pipe of feed pump, and air is forced into boiler; a fine spray issues from burner, which is lighted and burns fiercely, like a gas-jet. In five minutes or so steam appears, when the bicycle pump can be uncoupled, and the pressure rapidly runs up to the working point, when the engine can be started, and the blower shut off, and fire regulated to meet the consumption of steam by the oil and steam cocks. An atomiser the size given will easily give a quarter horse power, with a consumption of oil of one pound to seven pounds of water evaporated.

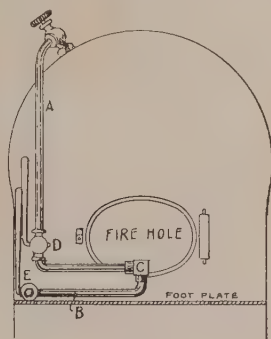


FIG. 2.

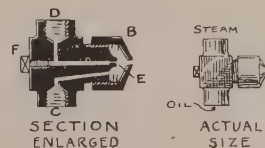


FIG. 3.

When properly made and adjusted there is no smoke and little smell. A low test oil is the best, but it will not work with naphtha. No novelty is claimed for it except its application on a very small scale on a model. If stopping and starting often, it is convenient to have a light fire of wood or coal in firebox to maintain an igniting temperature.

(To be continued.)

THE smallest electrician in the world is a fox terrier named Strip, belonging to a firm of electric light engineers in London. She is only three and a half years of age, and her business is to carry wire through the narrow tubes which connect the dynamos at the central station with the private houses, which duty she performs with the greatest skill and quickness, never failing to find her way through the most intricate passages.

A Model Steam Hammer, and How to Make It.

By F. E. P.

(Concluded from page 110.)

THE drawings and description already given suffice to show the general arrangement of the model, and those well acquainted with the making and working of steam machinery would be able to carry out the details to suit without much further help. It is, however, generally possible to do a thing in various ways, one of which will be found better than the others; the accompanying drawings are therefore given to illustrate the best method of carrying out the scheme of a working model steam hammer in detail.

The cylinder C is comparatively simple in design, and by comparing the outside elevations in Figs. 1, 2, and 6, and the sectional view in Fig. 5, its construction will be readily understood. It should be cast with two outside ribs (r, Fig. 5), for extra strength and appearance. The covers are both bolted down by seven 3-16th in. bolts, and one 1/2 in. bolt each, the latter being screwed in at a (Figs. 5 and 7), where little metal is left, owing to the steam ports. The bottom cover of the cylinder is provided with a stuffing-box, into which is fitted the gland G (Fig. 5). This is secured by two 5-32nds in. bolts screwing into the flange on stuffing-box. These flanges on gland and stuffing-box are elliptical, and should be filed up together. The cylinder and cover having been bored and turned in the usual way, and the steam face filed and surfaced, the ports must be marked off. A centre line should be scribed longitudinally, and another cross-wise, and the ports set out truly from these. The exhaust port will be 5/16th in., bridges 1/8 in., and steam ports 1/8 in. long, and all 1 in. wide: their position is shown in Fig. 6, the ports being shaded slightly on the edges. To make the ports—unless the maker is able to get them cast—use a 1/8 in. drill. Provide some means to enable the distance travelled by the drill to be seen, and then drill 1/8 in. holes as close as may be along each of the steam ports and the outer edges of exhaust port, to the depth shown in Fig. 5. Then referring to Fig. 7, drill six holes from each end of the cylinder, as shown, to meet those drilled from the slide-valve. As these holes are about 1 1/2 ins. long, they will require much care in drilling, in order to prevent either the accidental breaking of the drill or the possibility of the latter running out of its course and, perhaps, spoiling the casting. A portion of the cylinder casting at *h, b* (Figs. 5 and 7) must be cut away to give the steam access to the cylinder, and the drilled ports should be cut by the aid of a cross-cut chisel from the slide-valve face as at *sp, ep, sp* (Fig. 6).

The steam chest and slide valve are clearly shown in Figs. 5, 6, and 7, fourteen 1/8 in. screws being used to fasten the steam chest firmly to the valve face. The valve itself is of somewhat peculiar form, having a longitudinal slot at back to take the valve rod. This latter is screwed and locked in position by the two nuts shown, and is readily capable of adjustment in order to allow for the correct setting of the slide valve. The valve rod is continued upwards at *t*, being reduced in diameter to 1/8 in., and this tail piece works into a small chamber through a guide hole in the top of steam-chest. A plan of this chamber, which is a casting with an elliptical flange, is shown at H, Fig. 6; it should be provided with a lubricator on top to oil the slide-valve face, this being effected by means of the small hole drilled at H, Fig. 5. The valve rod works through an ordinary screwed gland at the lower end, with the usual packing.

The piston rod next claims attention. It is shown complete, but to a reduced scale in Fig. 9, the piston being illustrated in section in Fig. 5, and the tapered nose with the hammer head in Fig. 8. The piston, which should be made from mild steel, is fitted with three rings, three 1/2 in. grooves 3-32nds in. deep, being turned to receive them, with 3-32nds in. space between. The rings themselves would be best turned out of hard brass sheet 1/2 in. thick, and made of such diameter as to be just too tight to enter the cylinder; they should be bare 1/2 in. wide, and 1-16ths in. thick. After being turned they must be sawn through and sprung on to the piston, the saw cuts being made to "break joint." Either a steel forging or a piece of 1 1/2 ins. diameter rod may be used to make the piston and rod.

To render less dangerous the shock of the upward blow of the piston, the device shown at B, Fig. 5, is employed. This consists of a brass casting turned to the form shown, and kept standing above the head of the piston about 1/2 in. by a strong spiral spring. This buffer is controlled by the 1/2 in. screw firmly screwed into the piston at *p*, which also forms a guide for the buffer. A groove turned in the recess at *g* would help to keep the spring in place.

The hammer head (Fig. 8) needs some good workmanship and sound material. It should be made of tool steel, being left s f for machining. It is first turned all over to the outside dimensions, and then mounted in a self-centering chuck, with the larger end outward. A hole, 3/8 in. diameter, is then bored about 3/4 in. or 7/8 in. deep, by means of a drill. A suitable boring tool being then fixed, the slide-rest top must be set to the correct angle, and the hole bored out to the dimensions given. With the slide-rest still set at the given angle, the piston rod nose should be finished off, in order that it may have exactly the same angle as the hole in the hammer head. The keyways may then be made, those in the head being started by drilling 1/8 in. holes. The whole must be fitted so that when the folding wedges (K) are tightly driven in, there will still remain a space from 1-32nd to 1-16th in. below the end of piston rod. This being accomplished, the cotters may be knocked out, and the steel head hardened and tempered to a golden yellow colour on the face, leaving the rest of the head as soft as possible.

The guide shown in Fig. 2 is a simple casting of brass or gunmetal, and is in the form of a collar, with a projecting arm on each side. It should be bored out an easy driving fit on the piston rod and a 1/4 in. tapping hole drilled in the back, tapped, and provided with a set-screw to suit. This set-screw is not shown in drawing. The side arms must be filed to slide nicely on the slide bars, and it will be noticed that the guide is made to clasp the slide bars to prevent the piston turning round. When all fitted together, this guide should be adjusted to its right position on the piston rod, and the exact centre of the set-screw hole marked off on same. This point may be deeply punched with the centre punch, or the point of a drill may be entered. The set-screw being made with pointed end, will then securely hold the guide in its right place without fear of working loose.

It will be found a good plan to provide a "stop" top and bottom of the working lever (W, Fig. 1), to prevent too great movement. A steam buffer is sometimes provided at top of the cylinder in real hammers, but it will hardly be necessary in this case; and that described above forms a more compact arrangement altogether. If a model be made to half the scale, many parts can be simplified and the buffer may be dispensed with altogether. In conclusion, the writer will be pleased to assist any amateur who attempts this model, through the medium of the column devoted to "Queries and Replies."

Model Yachting Notes.

[The Editor will be glad if the Secretaries of Model Yacht Clubs will keep him advised of all doings of interest suitable for insertion in this column.]

WITH the publication of the October issue of this journal the summer yachting season is practically concluded, though it is a fact that many clubs continue their races well into the winter months, and in one or two cases make the coming portion of the year their chief sailing season. However, we think the majority of our readers will be spending more time in their workshops than at the lake side, and hence we have felt it desirable to somewhat re-arrange the yachting portion of our journal pending the arrival of another summer. While it is probable that during the winter our yachting matter may be rather more restricted in quantity, we do not propose to entirely ignore the claims of the boat-building and sailing section of our readers, and shall still do our best to keep them posted up in all that is of interest in this particular sphere. We shall be glad, therefore, if club secretaries will kindly bear in mind the editorial request which heads this column.

With regard to the publication of racing reports, it has been represented to us from several quarters that these items contain but little information and interest except for members of the clubs immediately concerned, as it is impossible for any reader who is unacquainted with the build of the boats mentioned to derive much instruction from such a statement as "Mr. Jones' *Polly* beat Mr. Thompson's *Miranda* by three points, *Ocean Queen* (Mr. Brown) being a good third." We propose, therefore, to considerably curtail this section of the journal, but shall nevertheless be pleased to record the results of inter-club races, and also other events which may be of more than ordinary importance.

One of the latest additions to the ranks of model yachting clubs is the Salford M.Y.C., formed in the early part of this year. The secretary is Mr. J. M. Morris, 17, Greenhill Street, Greenheys, Manchester, and he reports that the first season of the club has been extremely successful. The principal class is for two-foot boats built after one design with the same sail area, but there are several other types of boats in the club, and these are sailed under a time allowance arrangement. The *Zeta*, belonging to Mr. N. P. Blandy, though only 21 ins. long, has proved herself to be a particularly fast craft.

The Newsham Park M.Y.C. is one of the clubs having a winter racing season, this commencing on October 1st and terminating on April 30th, though ordinary sailing is carried on throughout the year. There are three classes of boats, viz. 5-, 10-, and 20-raters, and the club flag is a red square with white St. George's Cross, $3\frac{1}{2}$ ins. by 2 ins. The racing is conducted under the 1730 tonnage rule, which we are informed has been found to work exceedingly well. The club was founded in 1896, so it is now in its third season. The secretary is Mr. C. J. A. Bernasconi, 36, Hannan Road, Kensington, and the club motto is "Good fellowship."

By the way, seeing that there are at least six clubs in the Manchester and Liverpool districts, would it not be possible to arrange an inter-club tournament, or failing this, at least an inter city match? Liverpool has the advantage in point of number of clubs, but we should imagine that could such a contest be arranged, the Man-

chester men could produce some boats which would take a little beating. At any rate, such a contest would do much to rouse enthusiasm in the model-yachting circles of both cities and should provide some excellent sport. If a really good programme were arranged, possibly some of the Leeds M.Y.C. members would like to have a look in, too.

It may be news to many of our readers to learn that there is a flourishing model yacht club in Calcutta. A MODEL ENGINEER reader at Muzafferpore (Bengal) has been kind enough to send us a cutting from an Indian newspaper which gives an account of a regatta held on the Queen's birthday in May last. Altogether there were fifteen boats competing in four classes, the prize being a silver cup presented by members of the club. The members were "At Home" to their friends in a large shamiana erected adjacent to the club tent, and altogether the meeting was a great success. The hon. secretary is Mr. W. H. S. Harvey.

H.M.S. *Curacao* has lately been visiting Guernsey, where some special races have been organised with the local model yacht club.

The racing results of the Paisley M.Y.C. show that so far Mr. Finnie's *Forsa* heads the list with 5 firsts, 2 seconds, and 1 third.

The Cutter Cup of the Lowestoft M.Y.C. has been won by Mr. A. J. Thirtle's *Daffodil* with a total of 94 points in the six races; Mr. W. Carr's *Baby* being second with a total of 87. In the yawl competition, Mr. W. Adams' *Young Prince* takes the cup with 185 points in the six races; *Grayhound* (Mr. E. Linder) being second with 171 points; and Mr. A. J. Thirtle's *Georgiana* third, with 156 points. The *Young Prince* is therefore the champion yawl for 1899. Next year another cup will be offered by the club, to be styled the "Corporation Challenge Cup."

The annual race for the "North" Challenge Shield took place at Leeds on Saturday, September 9th, the result being:—*Pixie* (Mr. W. Fordsmith) first; *Midge* (Mr. Wells) second; and *Swallow* (Mr. Watkins) third. The course was across Waterlow Lake, in Roundhay Park, starting about 100 yards below the steamer landing-stage. There was strong north-west wind, and *Pixie* beat all previous records across the lake and back. The "North" Shield is a perpetual challenge trophy presented by Alderman North for competition amongst Yorkshire clubs only. It is sailed for by boats not exceeding 10 tons, measurement, YRA 1730 rule, on a scale of 1 in. equals 1 ft. only, and no time allowances are made.

The Liverpool M.Y.C. is perhaps one of the largest and best-known clubs in the country, and we are indebted to the hon. secretary, Mr. T. Adlington, of 20, Congers Street, Kirkdale, Liverpool, for sending us the club book of rules and the racing list for the current season. We note from the former that the club has a steamer division as well as a sailing division, separate racing rules being drawn up for each type of boat. The club dates back to 1862, but the present rules were revised and brought up to date in 1892. The honorary members then included the Mayor of Liverpool, the Earl of Sefton, the Earl of Harrowby, Viscount Cross, Lord Claud Hamilton, and many other prominent personages, and the list of executive officers appears to be a very strong one. The racing rule is the YRA 1730 tonnage rule, taking one inch equals one foot, though we notice in this year's list of races there is one fixture for a 20-rater class. The ton-

nage boats are divided into four classes of 10, 20, 30, and 40 tons respectively. The sailing takes place on Sefton Park Lake.

Another old-established club is the Glasgow M.Y.C., which is now in its twenty-fifth year. This club has an excellent list of patrons, including the Marquis of Ailsa, the Earl of Glasgow, Sir James Bell, Bart., and a numerous executive, at the head of which we notice the well-known name of G. L. Watson, as honorary commodore. The boats are raters, varying in size from 6 to 30; and the season is from April to October. The races are held on the new sailing pond, Kelvinside. The club is divided into two sections, senior and junior, and the subscription, entrance-fees, and races are varied to suit the requirements of each class. The hon. secretary is Mr. William Reid Birrell, 5, Rosslyn Terrace, Kelvinside.

At a meeting of the Port of Plymouth M.Y.C. held at the club room on September 6th, Vice-Commodore Gray presiding, it was announced that the hon. secretary, Mr. B. Travers-Stubbs, of 12, South Devon Place, Plymouth, had resigned his position. The news was received with general regret by the members. Mr. Travers-Stubbs has been succeeded in his duties by Mr. J. Bennett, 2, Victoria Place, Stoke, Devonport.

The Model 5-Rater Yacht "Audrey."

THE accompanying photograph, kindly forwarded to us by Mr. W. Cubbin, of Queenstown, shows the 5-rater model *Audrey*, owned by Mr. W. Vickers, of Devonport. The dimensions of this boat are as follows:—Length over all, 44 ins.; L.W.L., 30 ins.;



beam, 10 ins.; total draught, 10 ins. She is built of mahogany, and, therefore, does not carry the same quantity of lead as if built of pine. The glare in the photograph is due to her having a "tumble-home," and being polished.

Correspondence.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication. Communications should be written on one side of the paper only.]

Model Yacht Measurement.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I am glad to see the effort made to establish one rule for all model yacht clubs. Captain Gillett's rule:—

$$\frac{LOA + B + D + \sqrt{S}}{3}$$

is very good, but it very closely resembles the VRA Rule:—

$$\frac{LWL + B + \frac{1}{4}G + \frac{1}{2}\sqrt{S}}{2}$$

Then why not adopt the recognised rule? Otherwise, I favour Captain Gillett's second and simple rule:—

$$\frac{LOA + B + D}{2}$$

I would suggest another:— $\frac{2}{3}LWL + B + D$.

This last rule works out very much the same as the VRA Rule, so that a model copied from a large yacht would just fit in the model yacht class. The reason for omitting sail tax is that round many ponds, like our own, trees and shrubs have been planted by kind city fathers to protect the little boats from the rude wind. Our boats have enormous light-weather sails, and with these we have more sport on calm days. A sail tax would spoil this. Indeed, the object of the sail tax in the VRA Rule is only to prevent boats being dangerously over-sparred. This is not a danger in models.

I prefer LWL to LOA, because overhang may be divided into useful and ornamental. The latter includes graceful finishing curves at bow, and a sharp taffrail. We cannot tax one without the other.

In Liverpool district we have five clubs, all with different modes of measuring. We are hoping to bring about an inter-club match, but how much easier it would be if we all used the same rule.—Yours, etc., N. SMITH.
Liverpool. Newsham M.Y.C.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I am pleased to note that more than one of your correspondents is coming to the point of measuring the hull as a basis for taxing its power, including Mr. Behenna; but he blows hot and cold in trying to let the 6000 Rule down gently. I wish he had given us some illustrations of the "points" which he mentions, as it would help us to come to a decision thereon. The LWL Rule numbered most models in its day, but this was no evidence that the rule was good.

One great objection to the 6000 Rule is that its chief factor, *to a designer*, is unknown; it leads one to think that length is the only measurement there is in a yacht. The rule reads to me $\frac{L \times x}{6000}$; then obtain one of the Club tables, and thereon is a jumbled-up confusion of lengths and sail areas, which is got up to make the rule to go at all. Well! get *x* therefrom to suit the yacht, if you can.

With reference to Captain Gillett's formula, it appears to me that length is unduly taxed, and, in order to start a discussion on something tangible, I will affirm that 1 in. of B and D (= 2 ins.) is equivalent to 4 in. of L. Therefore, let us take as a basis one which measures 24 ins. by

6 ins. by 6 ins.; add B and D together = 12 ins. It is right to have 24 ins. for length with 12 ins. for B and D; then it *cannot* be right to tax 24 ins. as against 12 ins. One must be adjusted to the other, otherwise we get that stumpy, ugly craft which the L.W.L. Rule does, until, to equally tax, we must have one 12 ins. by 6 ins. by 6 ins.—obviously an absurdity. The Roath Park Rule meets this (hence the $B \div D \times 2$), and proportionately taxes excess in the measurements.

I should be glad if some would criticise the Roath Park Club Rule, either for or against; only let us have examples, and not generalities—such as shallow ponds, carrying models by railway trains, &c., which have nothing whatever to do with a good rule.—Yours faithfully,

O. B.

Cardiff, September 4th, 1899.

TO THE EDITOR OF *The Model Engineer*.

SIR,—The communications made to your journal last month have hardly solved the problem, the elucidation of which we used to conscientiously delve at in the *Model Yachtsman* every year (not the *Model Yachtsman* which made an ephemeral appearance about two years ago, but the one which had a long and useful life before that period).

Mr. Chas. E. Hancock advocates length, added to twice the sum of beam and depth, divided by four. How will this give a chance to the existing boats, and what kind of a boat will it produce when carried out to its logical result? The average 10-rater, L. and S.A. Rule, is 40 ins. by 10 ins. by 12 ins. The average 10-tonner, 1730 Rule, is 42½ ins. by 7½ ins. by 13 ins. By Mr. Hancock's rule the rater is 21 tons, and the 10-tonner is 20½ tons, which seems fair, but is not. Who has ever desired to sail 10-raters and 10-tonners on an equality? The rater would win every time, except in the lightest of airs, if their proper sail plans were used, and every time if sail was unlimited, the 2½ ins. of length not being as valuable as the 2½ ins. of beam. Let us then leave out the tonner, and take up the case of the rater, and see what sort of a chance she would have against a boat of the same tonnage, built under Mr. Hancock's rule. In the first place, the 10-rater having been built to sail under a restricted sail area, would have no chance against a boat of the same dimensions built to carry unrestricted sail, so that disposes of the logic of the rule being the least bit of a friend to the L. and S.A. rating boat; and this latter has, in my argument, already disposed of the chances of the 1730 boat. Therefore, this rule of Mr. Hancock's can be no attraction to vested interests. Mr. Hancock does not tell us what kind of a boat the rule has produced, and explained why it produces it.

The tendency of every rule is to progress towards a stereotype. It generally takes a bit of finding, but "when found is made a note on."

Let us say someone tries a set of dimensions such as used for his 10-rater, taking a little more displacement and ballast to properly use the untaxed sail area, 40 by 10 by 12, length, beam, and draught. The next builder sums things up and finds he can have 48 by 9 by 9. It looks as though 8 ins. extra length would more than pay for the sacrifice of beam and draught, if properly utilised, and if this is so the rule scarcely leads in the direction that model yachtsmen have desired to travel for improvements. I think, in framing any new rule, the old 1730 boats should not be studied; they are too far back, and having stuck in the mud so long, they may well be left out of consideration. If the L. & S.A. Rule can be improved upon by any other formula, and made sufficiently attractive for general adoption, it would no doubt be a good thing; but it is the best rule yet that

model yachtsmen have taken up, its only drawback being that in light winds things are a bit slow and look rather insignificant.

Before any one recommends a rule, he should ascertain what is wanted to promote good sport, and increase the popularity of the pastime. Model yacht sailing ceases to be attractive when it becomes hard work, difficult or expensive. These things may attract the few, but they discourage the many, and it is the many that will carry on the sport, or their withdrawal which will cause it to die. To prevent hard work, size has to be restricted, and excessive weight discouraged. To restrict size means, first and foremost, a limit of length, and to discourage weight, the easiest plan is to restrict sail area. This looks like the L. & S.A. Rule, but I do not mean it so exactly, as that rule allows you to decrease your sail to get the benefit of increased length, and no rule which allows juggling with several factors seems to produce what is desired by its inventors. To popularise inter-club competition, and enable interesting comparison to be made between different districts, the best thing is the adoption of one class; 40 ins. seems a suitable length, 10 ins. a good selection for beam, and it is much simpler to limit the sail area to give the amateur a chance than to limit the weight. Therefore, a class 40 by 10, with sail area of 2000 sq. ins., would make a first-rate class for general adoption—a class that anyone could build to. Its very simplicity would bring new recruits to the ranks, and its equality would promote inter-club sport. This class would yet set itself up to bring in old boats on a fair footing, although plenty of 10-raters and lengthers could try their paces in it, but it would encourage a lot of amateurs to build to it if it became the recognised class.

—Yours,

Hull.

THOS. A. BRUCE.

In the 15-rater race held on August 12th by the Tyne-mouth M.Y.C. Mr. W. Sharp's *Rover* and Mr. T. Foster's *Iverna* were first and second respectively. It is a noteworthy fact that these two boats, though the longest vessels in the race and therefore carrying a smaller sail area, have, in both club and inter-club races for "raters," always been very successful. A new cup for 10-ton models has been presented this year by Mr. Jas. Knott of the "Prince" line of steamers. This cup replaces one which he gave three years ago and which was won outright by Mr. W. Sharp.

There was a capital entry of twenty-three yachts for the first round of the Diamond Jubilee Cup race of the Barrow M.Y.C. on July 29th. The boats included 5-, 10-, 20-, and 30-raters, each sailing in their own class, and the first three boats in each class to race together in the final. In the final a time allowance of two minutes is given between each class. The race was sailed in the Ramsden Dock and attracted a large attendance of spectators. The results were as follows: 5-raters, Mr. H. Wickham's *Shamrock* first (time, 14 m.); 10-raters, Mr. J. Rome's *Flossie* first (time, 14 m. 30 secs.); 20-raters, Mr. P. Ham's *Jubilee* first (13 m. 10 secs.); 30-raters, Mr. A. Rome's *Louisa* first (11 m. 53 secs.)

Model engineers and amateurs in the Manchester, Newcastle, Dundee, and Leigh (Lancs.) districts are asked to respond to the invitation in this issue which will be found at the end of the Society of Model Engineers' notices.

Driving Work between Lathe Centres.

By "ATLAS."

WHEN a piece of work has been centred and placed in the lathe ready for turning, it is obvious that some sort of contact or connection must be established between the work and the lathe mandrel, so that the latter can "drive" or carry round the former, as it revolves. This connection is usually provided by means of a "driver-plate" or "catch plate" on the mandrel of the lathe, and a "carrier" or "dog" on the work.

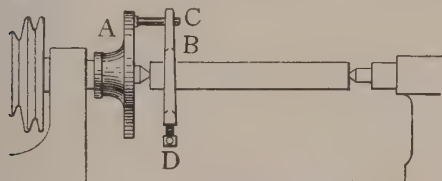


FIG. 1.

Such an arrangement is shown in Fig. 1, where A is the catch-plate and B the carrier. The catch-plate A is simply a small circular plate which screws on to the mandrel nose, and has a driving pin C screwed or rivetted into it at right angles near its outer edge. The carrier B is firmly fastened to the end of the piece of work to be turned by means of the set-screw D. It will be seen that the pin C catches the projecting tail of the carrier,

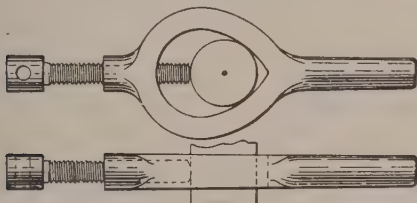


FIG. 2.

and thus drives the work round as the mandrel revolves. The shape of the carrier B will be more clearly seen in the two views in Fig. 2.

The point of the carrier screw should be slightly chamfered off, and should be hardened to prevent it burring over by the constant tightening down. Carriers such as shown in this sketch are sold very cheaply in various

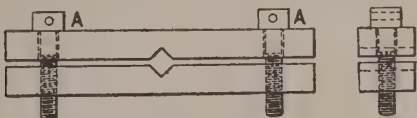


FIG. 3.

sizes, and, of course, each size of carrier will accommodate different sizes of work within its limits.

For very small jobs, and also for work of large diameter, the usual form of carrier has its disadvantages. For instance, not only is it difficult to properly grip very small jobs, but the carrier is heavy and unwieldy in proportion to the size of the work. In such cases a pair of clips, as shown in Fig. 3, are very useful. The work is gripped in the V-shaped notches, pressure being applied by tightening the screws A A. The holes in the upper

bar in the sketch are plain clearing holes, the screws being tapped into the corresponding holes in the lower bar. The bars should be made of wrought iron or mild steel, and a convenient size is about $\frac{3}{8}$ -in. sq. for each bar.

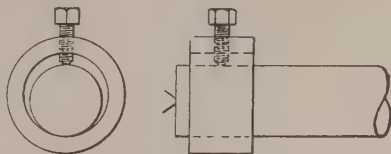


FIG. 4.

For work of a fairly large diameter which has not to be subjected to a very heavy cut, an ordinary collar with a set-screw, in Fig. 4, makes a convenient form of carrier. In this case the pin on the catch plate drives against the set-screw, and as the latter has thus to take all the driving strain, it is easy to see why this plan is not suited to heavy work. For odd work, however, it is frequently of service.

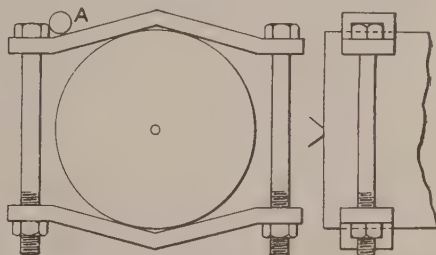


FIG. 5.

It occasionally happens that a big job has to be put between centres, which, though small enough to easily clear the lathe bed will not admit of much projection of the carrier. For such cases the usual device is a pair of "straps," as they are termed, as shown in Fig. 5. The driving pin of the catch-plate will then fit against the strap next one of the bolt heads, as shown at A. It will probably be found that the ordinary catch-plate is too

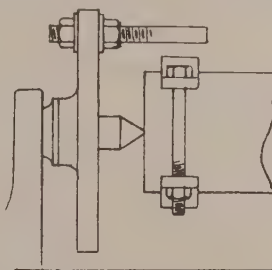


FIG. 6.

small for a job of this size, in which case one must be improvised by using the face-plate. This can readily be done by inserting an ordinary bolt through one of the slots, or holes, in the face-plate, and fixing it up in place with nuts and washers, as in Fig. 6. The head of the bolt should be previously cut off with a hack saw, so that the body of the bolt may engage directly against the strap.

Model Railways.

II.—A Model Great Northern Line.

WITH all model engineers the famous Great Northern trains are deservedly popular, and we are not surprised, therefore, that the Rev. T. B. Parley, of Darlington, should have selected this line as his guide when planning and equipping the model line which we have pleasure in herewith illustrating. Both engine and carriages have a very business like appearance, and we are glad to learn from their owner that the performance is fully up to the expectations which naturally follow an examination of the photographs we reproduce on the opposite page.

The line is laid down in a garden, the total length of track being 120 ft. The line is double for half the length, and the two converge with points and junction signals, &c. There is a tunnel about 15 ft. to 20 ft. long, composed of two large drain pipes (one at each end), the intervening space being covered with wooden boxes, and then covered with earth, the ends of the tunnel being finished off with wooden palings to look real.

The two stations, Grantham and Newark-on-Trent, are composed of planks and wooden boxes fashioned to represent the buildings. There is one bridge over a foot-path, which can be taken up to allow of the path being used when desired.

The signals, of which there are sixteen, are all worked from two points, one at each end of the tunnel, and are manipulated with strings, balance-weights, wires, and levers. The rails are of common T-section iron, which is very cheap. The horizontal part is fixed into blocks of wood which answer for sleepers, holes being drilled at a distance of 2 ft. 6 ins. apart. There is also a turn-table at one end of the line.

The engine is a very correct scale model of one of the celebrated G.N.R. express 8-ft. bogie-engines, and was recently rebuilt by Messrs. Martin & Sons, East Ham. The working pressure is 45 lb. per square inch. The diameter of driving wheels is 5 ins. The boiler is fed by a hand-pump fitted into the well of the tender, and when not in use is invisible. The steam is raised by a methylated spirit lamp, which is fed from another tank on the tender. The boiler steams rapidly, there being two large tubes, and these being fitted with cross tubes.

The engine travels at a great speed when running light, and pulls a train of five or six carriages at a scarcely reduced speed. The carriages are of cardboard, on wooden frames, cardboard roofs, metal wheels, and bogie frames. The train consists of two G.N.R. vans, one ordinary composite, one Pullman drawing-room car (M.R.) and four ordinary composites, each 2 ft. 6 ins. long. These last have sides of thin wood, and roofs of oilcloth, which is easy to fit to the shape of G.N.R. roofs. The cardboard carriages were made (with the exception of the metal work) by the owner, the Rev. T. B. Parley, the last four being only fitted together by him, the sides being made to order.

An interesting gyroscopic device, termed the "oscillo-meter," has been put on the market by a Milanese firm. It consists, says the *Scientific American*, of a small electric motor mounted in gimbals like a ship's compass, with its armature running in a vertical position at a very high rate of speed; the frame of the instrument being attached to the vessel, follows any change in direction. As the ship rolls, the armature maintains its original position, while the frame, of course, follows the motion of the ship. Thus any change in the direction of the vessel is at once indicated.

X-Ray Experiments for Amateurs.

By NESBITT O'D. BURNS, B.A.

(Continued from page 181.)

THE only question that now remains is how to combine our apparatus, so as to produce and use the rays. There are at least three ways of doing this, and first I will describe the simplest one.

We must first find out which of the discharging rods of the machine gives off positive electricity. This is done by bringing the machine into a dark room, placing the rods as far apart as possible, and working the machine.

Now it will be noticed that from one of the rods there comes a brush-like display of light which is not seen on the other one. This is the positive pole.

Next if we look at the focus tube, we see that inside it are two pieces of metal—one round and cup-shaped and the other square and flat.

Each of these is connected with the outside of the tube by a small metal loop. The square piece of metal is the positive pole, or "anode," and the other is the negative, or "kathode." The tube may now be placed on its stand.

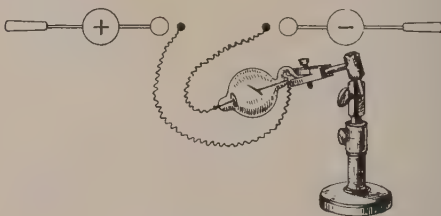


FIG. 2.

Now a piece of short, thick, silk-covered wire is attached to the loop of platinum which comes from the positive pole of the tube, and is brought close up to, but not so as to touch, the positive discharging rod. Then another piece of wire is attached to the loop from the "kathode," and brought up close to the negative discharging rod. This is shown in Fig. 2.

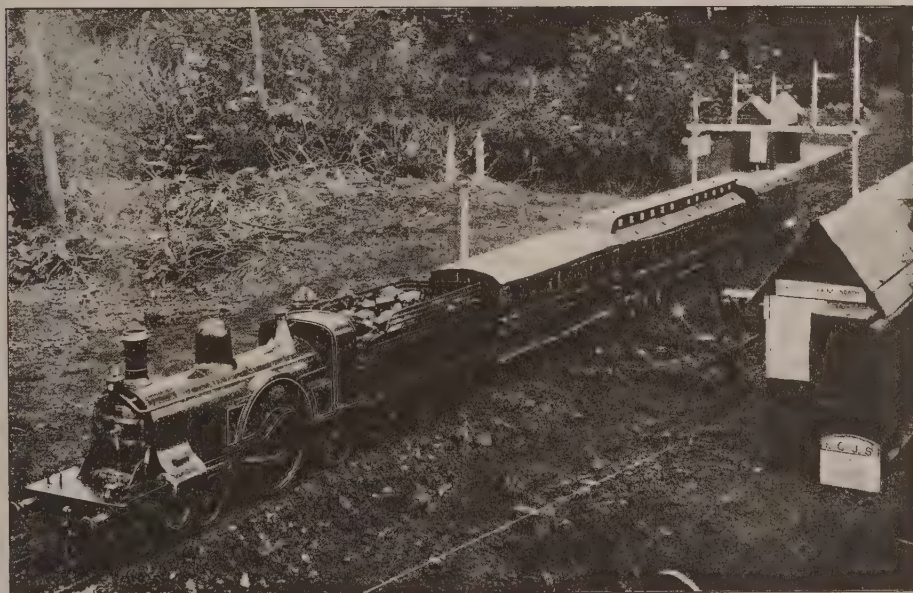
These wires must not touch anything, on their way from the tube to the rods, that would be likely to conduct the electricity to the ground. The best way to keep them in their places is to get a pair of tall glass bottles, one for each wire, and to wind the wire once round the neck, letting the end stick out close to the discharging rod. A neater way, perhaps, is to have a couple of pieces of glass tubing fixed into small pieces of wood, and to use these instead of the bottles.

Now, when the handle of the machine is turned, a continuous succession of sparks is seen to pass between the rods and wires, and the tube lights up with a beautiful green light.

It will be noticed that only part of the tube is illuminated, as the flat piece of platinum appears to reflect the light on to the glass in front of it. From this part of the glass the x-Rays proceed, but, of course, until the screen is used, they are invisible. The green light seen in the tube is called the kathode light, or kathode rays, but is supposed to be quite different to the Röntgen rays. On now putting the screen up near the tube, and looking down the cardboard cylinder, the screen will be seen to



ARRIVING AT NEWARK-ON-TRENT.



LEAVING GRANTHAM STATION.
THE REV. T. B. PARLEY'S MODEL GREAT NORTHERN RAILWAY.
(For description see opposite page.)

be brightly lighted up. If the hand is now placed on the outside of the screen, the shadows of the bones may be quite plainly seen, with the lighter shadow of the flesh around them.

To take a photograph, all that is necessary is to wrap a plate up in brown paper, or insert it in an ordinary photographic dark slide, and place it under the tube at about 6 ins. distance from it, the prepared surface of the plate being next the tube. Now the object to be photographed is placed on the plate, and the machine steadily worked.

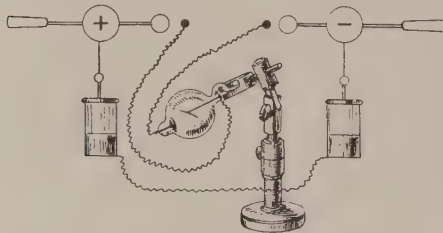


FIG. 3.

The time of exposure varies with the thickness that the rays have to penetrate, and is best learned by experience. With the machine and tube I have described, two minutes is enough for metal objects enclosed in a box, while for the hand six or eight minutes is necessary. The time may be greatly shortened by making a screen on paper (taking care that the tungstate is spread on very thinly and without lumps), and when dry placing this face downwards on the prepared side of the plate, before wrapping up the plate in paper. By this the plate is acted on by natural light from the screen, and *x* Ray light from the tube, and the time of exposure is reduced by nearly one half.

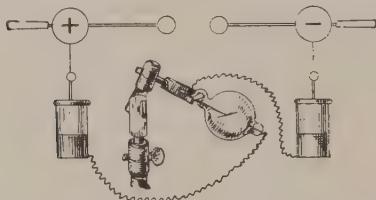


FIG. 4.

This is one way of combining the apparatus. Another way, which is especially good for photographs, is to use very small Leyden jars. They may be made in this way: Get a pair of plain flower vases, about 3 ins. high and 2 ins. across the bottom. Gum some tinfoil on the bottoms and sides for the height of an inch, both inside and outside. Put corks in the jars, and pierce the corks with a thick piece of brass or copper wire, of about 6 ins. long, placing it so that it reaches to the bottom of the vase, and so sticks up outside for about 3 ins. Make a small round ball of sealing-wax, and stick it on to the rough end of the wire. When these jars are quite dry they are ready for use. Now place one of these opposite each collector, on a piece of glass, and connect the collectors with the wires of the jars by a short copper wire. Next connect the outer coatings of the jars with each other by a piece of wire, and place the tube as before. This arrangement (Fig. 3) lights the tube up better, and gives a stronger ray, but, the light not being so continuous, is not so suitable for screen work as the other, although better for photography.

Another method (Fig. 4) is, to connect the outside coatings of the jars directly with the tube instead of with each other, but in this case the jar opposite the positive collector is connected with the "kathode" of the tube; and that opposite the negative, with the "anode." Also the gap of about an inch is left between the ends of the discharging rods. By this arrangement, when sparks pass between the rods, the tube lights up. This is also a good combination for photography. The whole secret of success in using Leyden jars, I have found to be in getting sufficiently small ones, as with larger jars the light is much too intermittent to be of any use, and also there is danger of cracking the tube by the powerful discharges.

I think I have now shown that a very good *x*-Ray apparatus, including photographic plates, chemicals, and everything necessary, may be bought for under 65s.

Heretofore, to experiment with the rays it has been considered necessary to spend at least £10 or £15.

Of course, with a larger Wimshurst machine, better effects would be produced, but at an increased outlay, and the machine I have described gives very good results indeed.

If preferred, the machine may be made at home, as described in *THE MODEL ENGINEER* for July, 1898, or the parts may be obtained ready for putting together, and by this means a saving may be effected, by anyone of ordinary ingenuity.

A smaller Wimshurst may be purchased for £1, giving about $1\frac{1}{2}$ ins. or $2\frac{1}{2}$ ins. spark, but the larger one is the better value for the money.

Also, a tube may be bought for as little as 5s., but it is not to be recommended.

As stated by several writers, the great objection to the Wimshurst was its liability to go out of order at awkward times, on account of damp or dust getting at it; but my experience has been that with a little ordinary care, and by keeping it always in one room which is warm, dry, and free from dust, it gives no trouble whatsoever.

The only time that it is at all likely to give trouble is in very wet weather, when the air is saturated with moisture, and in weather of this kind it needs a thorough wiping with a silk handkerchief before using it.

I always keep a saucer of paraffin oil under mine when not in use, as the vapour condenses on the machine and protects it from damp.

The Society of Model Engineers.

THE usual monthly meeting was held on Wednesday, September 13th, at the Memorial Hall, Farringdon Street, E.C., Mr. Percival Marshall presiding.

THE CHAIRMAN announced the intention of the committee to organise a conversation for the month of November, and expressed the hope that the members would make a point of showing as many models as possible on this occasion. The programme for the evening would include music, short lantern lectures, scientific demonstrations, and light refreshments, and, of course, lady visitors would be expected. A small charge for tickets would be made to cover expenses, and particulars with regard to this and the other details as to date, place, etc., would be announced in due course.

MR. J. C. CREBBIN endorsed the chairman's remarks on the necessity of making a good display of models, and said that a successful affair such as it was intended this should be, would go a long way towards increasing the membership of the society.

MR. E. L. PEARCE exhibited a model vertical engine, which, though made some forty years ago, was still in perfect working order, a fact which was demonstrated during the evening. Mr. Pearce also showed some

beautiful working drawings of a full-size locomotive. Mr. J. S. Drewry showed a model cruiser of his own construction and design. An interesting feature of this model was the arrangement for burning *vapourised* methylated spirit in the boiler furnace, instead of the raw spirit as usually employed in models. The effect was not only to greatly increase the heating power of the lamp, but to effect considerable economy in the consumption of the spirit.

Mr. H. S. Boorman showed a well-finished cylinder for a model engine he had in course of construction, and also a neat model force pump.

Mr. G. Braine brought a handsome model toater sailing yacht, which attracted much attention, and Mr. R. J. Lowne exhibited an instrument for recording the capacity of a person's lungs. Several of the members subjected the latter to a practical test, but nobody succeeded in raising sufficient wind to cause the needle on the recording dial to pass the limit mark.

The American Talking Machine Company kindly sent a representative with a gramophone and a good collection of records, with the result that a very interesting and amusing demonstration of the powers of this appliance was given. Mr. Nottingham explained the construction of talking machines to the members, and promised to read a descriptive paper on this subject at a future meeting of the society.

Mr. E. C. Prince sent a collection of twenty attractive photographs of various ocean steamships.

THE NEXT MEETING.

The next meeting of the society will take place on Thursday, October 5th, at the Memorial Hall, Farringdon Road, E.C., at 7 o'clock, when Mr. G. Braine will read a paper on "The Construction of Model Yachts." If time permits, Mr. Percival Marshall will also read a short paper on "Workshop Methods."

SPECIAL VISIT.

We are pleased to be able to announce that Dr. Gerald Hovenden, of "Arbor End," 153, Selhurst Road, South Norwood, S.E., has very kindly consented to allow members of the society to visit his house on Saturday afternoon, October 14th, to inspect a model railway, which he has constructed in conjunction with his brother, Dr. Arthur C. Hovenden. The model is a correct representation of the L.B. & S.C. Railway between London Bridge and Victoria and East and West Croydon. The motive power is clockwork, the engines having been specially designed and built for this railway by Dr. J. Bradbury Winter, of Brighton, who is an honorary member of the Society of Model Engineers, and who will, it is hoped, be present on the above occasion. Members coming from the City are requested to meet at London Bridge Station in time to travel to Norwood Junction Station by the 2.38 train; members coming from other parts should arrange to meet this train on its arrival at Norwood Junction. It is particularly desired that all members who intend to take part in this visit, will send a post-card to that effect to Mr. Percival Marshall, 6, Farringdon Avenue, London, E.C., not later than October 10th.

FUTURE MEETINGS.

The November meeting of the society will be the annual general meeting, at which the election of officers and revision of rules for the ensuing year will take place. This meeting will be distinct from the conversation, the latter being an extra meeting, and taking place on a different evening. Members are reminded that notice of any motion for altering the existing rules should be sent in to the secretary not later than October 31st.

At the December meeting, Mr. A. M. Bushell has promised to read a paper on "Automatic Brakes, and their application to Model Trains." The dates of the above meetings will be announced in due course.

MUSEUM MEETINGS.

The committee of the society have discussed the suggestion as to a recognised evening for members to visit the Machinery Section of the South Kensington Museum, and have decided to adopt Tuesday evening as the society evening. By this arrangement, although there are no definite meetings provided for, it is hoped that those members who frequently visit the South Kensington Museum will, as far as possible, arrange to go on Tuesdays in preference to other days, and thus be able to meet one another for the examination and discussion of exhibits.

BRANCH MEETINGS.

BRADFORD.—The monthly meeting of this branch was held on September 4th, when Mr. F. Wilson took the chair at 8 o'clock. After formal business had been disposed of, the company viewed the exhibits, which included a pair of well-finished high-pressure cylinders, shown by the chairman. The next meeting of the society will be held at the Coffee Tavern, Tyrell Street, Bradford, on Monday, October 9th, at 7 o'clock. Members are requested to bring any models which they have recently completed, or other items of interest. The committee have arranged special subjects for the coming winter session. Mr. A. P. Drake will lecture on *Dynamics*; Mr. H. Firth will lecture on *Corliss Valve Motion*, and Mr. J. H. Lamb on *Model Engine and Boiler Construction*. Readers of *THE MODEL ENGINEER* who are thinking of joining this branch are cordially invited to attend as visitors. The members of this branch visited the works of Mr. F. Brearley's engineering works at Shipley on August 19th. Mr. H. Brearley escorted the members through the works and showed them every item of interest. The members spent a very enjoyable afternoon, and passed a vote of thanks to Mr. H. Brearley for his kindness. J. H. Lamb, hon. secretary, Holly Bank, Thornbury, Bradford, Yorks.

SHEFFIELD.—The ordinary monthly meeting of this branch society took place at the rooms of the Y.M.C.A., Sheffield, on September 14th. Mr. Shaw took the chair at eight o'clock. It was decided that the date of future meetings should be altered from Thursday to a more convenient day, as several members—owing to classes at the technical schools—were unable to attend. At the suggestion of Mr. Shaw it was decided to ascertain the number and kind of exhibits members would be willing to place on view at the Industrial Exhibition to be held in Sheffield in November. The models provided by members were next viewed. Mr. Hudson showed to what use old and discarded tools may often be put by producing a screw-plate, gauge, an obstinate nut remover, and a reamer—all made from an *old flat file*. Mr. Skinner interested the company by giving a clear and concise description of his method of making the eccentric gearing of his model loco. A couple of splendid reamers, specially made for model work by Mr. Shaw, were passed round for inspection. Mr. Rooke exhibited also a model electric fan.

MEMBERS WANTED FOR NEW BRANCHES.

The following gentlemen have kindly promised to assist in the formation of branches for their respective districts, and they will be glad if all *MODEL ENGINEER* readers in the localities mentioned who would be disposed to join, will communicate with them at once, so that definite steps may be taken to get the matters into shape:—**NEWCASTLE-ON-TYNE**.—Mr. G. Bousfield, 14, South View, Felling-on-Tyne.

MANCHESTER AND SALFORD.—Mr. S. L. Thompstone, 27, Nelson Street, Broughton, Manchester.

DUNDEE.—Mr. John Wilson, c/o Mr. G. L. Wilson, "The Corner," Dundee.

LEIGH (Lancs.).—Mr. J. P. Forbes, Thistle Villas, Railway Road, Leigh.

Our Beginners' Page.

How to Make a Cheap and Simple Lathe.

By "QUI VIVE."

TO be the possessor of a lathe is the ambition of most amateurs, especially those who from the nature of their hobbies are subscribers to THE MODEL ENGINEER; and, although a good many have simply to put their hands in their pockets to supply the want, yet there are probably many more who have to be content with the wish only. It is to enable these latter readers to obtain a serviceable lathe for a few shillings that this article is written; and, in case there may be any doubting Thomas among my readers, I will just state that a lathe made in exactly the same way as the present one was used regularly by the writer and others for many years, not only in turning wood but also occasionally iron and brass, and never failed to give every satisfaction.

The parts to commence on are the two legs, or standards, one of which is shown in elevation in Fig. 1. Each standard consists of four pieces:—A, the sill; B, the standard; and C, C, the braces: the sizes of each being as follows:—A, 2 ft. long, 3 ins. by 3 ins.; B, 3 ft. 9 ins. long, 3 ins. by 3 ins.; and C, C, 2 ft. 3 ins. long, 3 ins. by 2 ins. One standard will finish at the top of bed (D, Fig. 1), therefore one of the pieces B will only require to be 3 ft. long. All the above must be planed up straight, square, and parallel; and this applies to every piece throughout the lathe, so that it may be taken for granted and I shall not mention it again. The sills must be mortised, as shown in Fig. 2, the braces being tenoned to fit and also to fit into the standard, as shown in Fig. 3. The standard is shown in Fig. 4, being tenoned to fit into the sill and mortised to receive the top ends of braces. The positions of the mortises, also the bevells of the shoulders, are obtained by laying out the several pieces to the exact shape they have to be, when they can be easily marked.

The standard and braces are secured to the sill with pins, and the top ends of the braces are fixed by means of a screw-bolt, as shown in Fig. 1. The standard must be reduced, as shown, for a width of 6 ins. to receive the two pieces which form the bed, the depth of the reduction at each side being $\frac{3}{4}$ in., thus leaving a thickness of $1\frac{1}{2}$ ins. in the middle (E). The top of the high standard must also be rounded off neatly, as shown.

The two pieces forming the bed must next be prepared and bolted on as shown in Fig. 5. They should be 4 ft. 6 ins. long, 6 ins. by 2 ins., and fixed at each end with two bolts. The top of the lathe is now as Fig. 5, and the long standard at the left will be seen to be for one part of the headstock. The remaining part of this can be made next. The top of this must be an exact facsimile of the top of standard, and it must have a long tenon to fit closely in the slot of bed, and project $4\frac{1}{2}$ ins. below it. In this projecting part a bevel mortice must be made, as shown at G Fig. 6, and in this mortice a taper wedge is fitted, so that when the tenon is between the two sides of bed, the wedge is driven in underneath, and clamps it tightly in its place. The arrangement is shown clearly in section in Fig. 7.

We can now proceed to fit up the mandrel bearings. A screw as Fig. 8 must be obtained from the nearest smith (as it can hardly be made at home without special tools) $\frac{5}{8}$ ins. long by $\frac{5}{8}$ in. diameter, threaded nearly the whole length and having two holes drilled through at right angles to each other at one end, the other end being filed up as truly as possible to a conical point. A hole $9\frac{1}{16}$ ins. in diameter must now be bored through the high standard at the centre of the circle as shown, and as

it is very important that this hole should be perfectly true, it must be bored from both sides of the standard, and then the screw (Fig. 8) must be inserted in the above hole from the outside of the standard until the conical point projects on the inside.

Now obtain a piece of steel spindle, 9 ins. long by 1 in. diameter; file one end as square across as you can, and mark with a centre punch; then, with a twist drill, bore a small hole in endways to the depth of $\frac{1}{4}$ in., afterwards enlarging this with a countersink, so that the conical point of screw will fit nicely in it. Two pieces of mandrel-drawn brass tube, 1 in. long, are now wanted, the right size for the spindle to fit closely in them, as they are to form bearings for the mandrel. These tubes are inserted one at each side of the movable part of headstock (Fig. 6), which is easily done by boring a hole of the right size for the tubes to drive tightly in, afterwards continuing the hole with a smaller bit. The tubes are shown in position at H, (Fig. 9) (in section), and also in Fig. 10 (elevation). A hole for lubricating purposes must be bored from the top downwards through the tubes, as at I, being kept clear of dust, &c., by means of small round head screws, as shown.

The part with the bearings in must now be placed in position in the lathe bed, and clamped tightly at such a distance from the long standard that the spindle, when placed in it, will reach to within $\frac{1}{2}$ in. of the latter, and the other end will project through to the right hand about $1\frac{1}{2}$ in. The screw (Fig. 8) can then be inserted in the hole made for it in the long standard, and if this hole was bored quite true, and the bearings also put in true, the conical point will come to the hole made for it in the end of spindle.

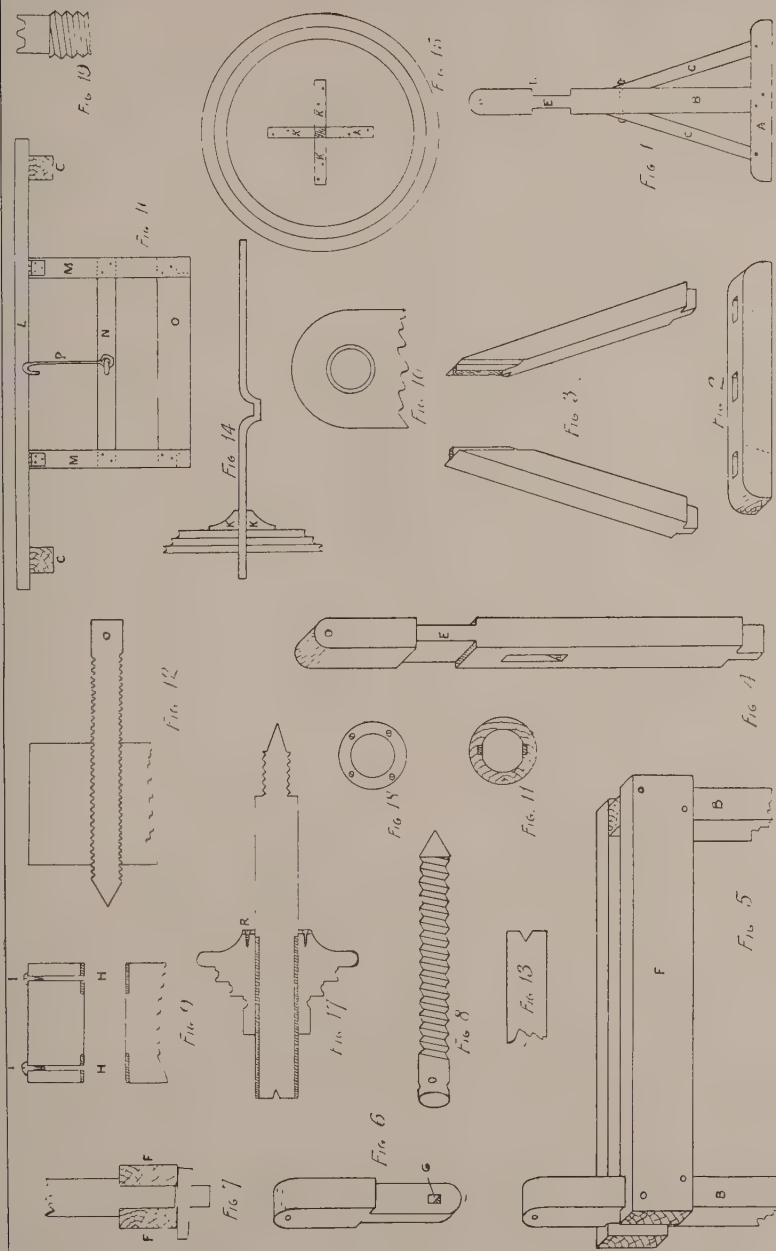
As it is quite possible that the bearings may not have been put in true enough for this, the shoulders can be altered where they fit on the bed so as to make it come exact, and this must be done before going any farther. The spindle can now be removed from its bearings, and two flat surfaces filed on it opposite each other for a distance of 4 ins. from the left-hand end. These are for the keys which hold the mandrel pulley in position.

The pulley is made from a piece of beech, 3 ins. long by 4 ins. in diameter; this must have a hole bored through it endways, the right size for the spindle to fit in tightly, and, before drawing it on, two small keyways should be made in it corresponding in position to the flat surfaces which form key-beds. The pulley can now be driven on, and the keys (which should be slightly taper) driven in, when they will hold it firmly in its place. The end of pulley, with keys in position, is shown in Fig. 11. This part must be left until the pulley can be finished by turning it to the proper dimensions.

The next part to make is the movable poppet. This is an exact *facsimile* of Fig. 6, so far as the wood is concerned; but instead of the bearings being fitted, this must have a hole bored through in the same way as the long standard, and a screw fitted to work in it in the same way, the point being filed up to a true cone. A portion of the poppet with this screw in position is shown in section in Fig. 12.

We now come to the crankshaft. This is simply an iron rod 1 in. in diameter, with a crank formed in the middle; the full length required is one much less than the distance between the two standards of lathe, and as it runs on centres a hole must be drilled and countersunk in the centre of each end of shaft. The centres for crankshaft to run on are formed by two screws, as Fig. 8; these are inserted in the middle of standards (B) at $1\frac{1}{4}$ ins. from the bottom side of sills (A). A section of the end of crankshaft is shown in Fig. 13.

(To be continued.)



A CHEAP AND SIMPLE HOME-MADE LATHE.

DESCRIPTION OF FIGURES.— (1) Right-hand standard of lathe complete. (2) Sill of ditto showing mortises for standard and braces. (3) Braces showing tenons to fit in above mortises. (4) Standard tenoned to fit in sill and morticed to receive brace. (5) Top part of lathe showing connection of bed with standard. (6) Movable part of heelstock, also pupet head. (7) Section showing method of fixing Fig. 6 to bed. (8) Screw forming centre for mandrel spindle, also tail centre of lathe and centres for crankshaft. (9) Section of part of heelstock, showing bearings for mandrel spindle. (10) Front elevation of Fig. 9. (11) End elevation of mandrel pulley, showing method of fixing to spindle. (12) Section of pupet head, showing screw centre. (13) Section of end of crankshaft, showing conical bearing. (14) Section of crankshaft, with flywheel mounted. (15) Elevation of flywheel. (16) Plan of treadle complete. (17) Section of mandrel, with pulley turned to shape. (18) Right-hand end of pulley, showing brass bearing. (19) End of mandrel spindle, showing spur centre.

Practical Electrical Papers for Beginners.

By A. P. DRAKE.

I. How to Make an Electric Bell.

IT is intended in this series of papers to deal with the construction and management of electric bells, indicators, &c., with their various accessories and applications. For the benefit of the younger readers of THE MODEL ENGINEER there will, wherever possible, be given a description of the cheapest and most easily made form of the piece of apparatus under consideration, together with the ordinary or commercial form—illustrated, of course, by the necessary diagrams.

It is not necessary to describe in this paper the ordinary Leclanché cell, as it has, in the Carporous type, been already fully explained in the April and September, 1898, issues of this journal. This cell is made in three sizes—the No. 2, or quart size, being the one in general use for bell and telephone work. The No. 2 size costs about 1s., and is, all things considered, cheaper to buy than to make at home.

We will, therefore, take in hand the construction of an electric bell—say, with a $2\frac{1}{2}$ -in. gong. We shall require a piece of 5-16ths in. round iron, bent into a horseshoe or, rather letter U shape, and $1\frac{3}{4}$ ins. long in the straight and 9-16ths in. apart inside. This is for the magnet core. Soften the core by placing it in the kitchen fire overnight, and taking it out of the ashes in the morning. By this method the iron is made red hot and very gradually cooled, thus making the metal as soft as possible. Now clean off the scale, and file up the ends true and square with each other.

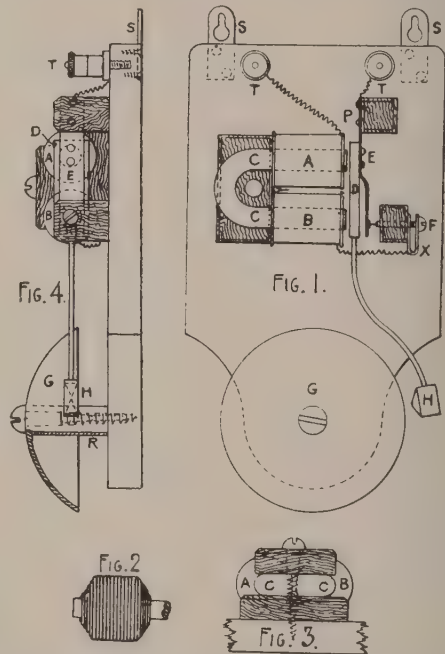
We now proceed to make the magnet coils. There are two methods of winding these coils. One is to make a bobbin of stout brown paper, 1 in. long, to fit each magnet link. The bobbin ends may be either brown paper, cardboard, thin fretwood, vulcanite, or fibre, but they must be firmly fastened to the brown paper tube. The ends should be 1 in. diameter.

The other way is to make a paper tube, and then wind the first layer of wire the length required—1 in. The next layer is left one turn short, and the layer above another turn short at each end, as in Fig. 2. This method saves the trouble of bobbin ends, but is much more difficult to carry out, as, if due care is not taken, the wire falls away at the ends of the coil. Having decided on our method of winding, we rig up a little windlass with a spindle to fit in our bobbins. We shall require a 4-oz. reel of No. 22 green, either silk or cotton covered wire. If white covered wire is used, the coils will require a coat or two of shellac varnish when wound. This is made by dissolving orange shellac in methylated spirit. Two coats of rather thin varnish will give a much better finish than one coat of thick. The 4-oz. reel will be ample for our purpose. Leave about 6 ins. of wire before commencing to wind, and wind each coil full, that is, to about 1 in. outside diameter, with about 6 ins. to spare at the finishing end. Wind each coil in exactly the same way and direction. Now slip the coils on the magnet limbs so that the iron projects a good 1-16th of an inch beyond the coil ends, and with both starting ends toward the bend. Make a short coil of each starting end by winding the wire round a piece of $\frac{3}{4}$ -in. wire, clean the ends for about 1 in. up, twist, and solder them together.

The baseboard next claims our attention. It is made from a piece of mahogany, walnut, or even deal will do, if anything else cannot be had. A piece of wood $\frac{1}{2}$ in.

thick, and $6\frac{1}{2}$ ins. long by $3\frac{3}{4}$ ins. wide, will be required.

The lower corners should be cut away as in Fig. 1. The base may be either polished or varnished. We also require a saddle of hard wood about 5-16ths in. thick on which to screw the magnet. A piece of wrought iron $1\frac{1}{2}$ ins. long, $\frac{1}{2}$ in. wide, and $\frac{1}{8}$ in. thick is now annealed in the same manner as the magnet core, and then filed up true and square for the armature D. A piece of old clock spring, $\frac{1}{8}$ in. wide is now bent to form shown in Fig. 2. The end P has two $\frac{1}{16}$ in. holes punched in, and the end O, a small piece of platinum, soldered on. The hammer H is made from a piece of 1-16th-in. iron wire, on one end of which is driven a piece of brass either in the form of a ball about 7-16th in. in diameter, or shaped



like the figure. The other end of the wire is firmly driven into the end of the armature. The clock spring is now soldered on to the armature in the position shown. If the worker has the tools, a better job is to rivet the spring to the armature, as in Fig. 1 at E.

Now take a brass wood screw (F) about 1 in. long, and file off the point. Drill 1-32nd in. hole about $\frac{1}{8}$ in. deep in the end; and solder in a small piece of platinum wire. The end of the wire is now gently hammered over the end of the screw until it is about 1-16th in. diameter. A small piece of thin spring brass, 1 in. long and $\frac{1}{8}$ in. wide, is bent like X in the figures and drilled to just clear the screw just made.

We can now proceed to put the bell together. Commence by setting out the parts as shown in Figs. 1, 3, and 4. The magnet is fixed in position by means of the large wood-screw, as shown in Fig. 3. The lower block of wood, and also the two smaller blocks which carry the armature and contact screw, are fixed in position by

screws from the back of the baseboard. The armature is placed so that its centre line is the same height as the centres of the magnet ends and $\frac{1}{8}$ in. clear of the ends.

Now place the contact screw block in position, and mark on the armature spring a point just opposite the platinum point of the screw. A small piece of platinum is soldered on the spring at this point. These pieces of platinum can be got at an electrical stores for about 2d. or out of an old incandescent lamp. Get a broken or "burnt out" lamp and dig out the plaster in the cap. You will then find two scraps of a silver-like wire going through the glass. These are the platinum pieces required.

The gong G is better bought, and will cost about 3d. It is mounted on a short piece of brass tube (R) so that the hammer will strike it about $\frac{1}{8}$ in. above the rim, as in Fig. 4. Two small hangers are let into the back of the baseboard, as shown in Fig. 1, and a couple of terminals (T) screwed into the baseboard will complete the bell, except that it requires "connecting up."

This is done by taking the finishing end of the upper coil and coiling it round a piece of $\frac{1}{8}$ in. wire. Bare and clean about 1 in. of the end, and fasten it under the left-hand terminal. The finishing end of the lower coil is coiled and bared the same way, but the end is wrapped round the bend of the small brass U, and soldered in place. A short piece of wire is now coiled round the 1 in. wire, and both ends bared and cleaned. One end is fixed under the right hand terminal, and the other end is placed under the screw head which holds the armature spring to the wood block.

Our bell is now complete, except for a small wood box made from an old cigar box, to cover in the works. The cover must have a slot cut in the under side to allow the hammer shaft to work.

For the Book-shelf.

[Any book reviewed under this heading can be obtained from THE MODEL ENGINEER Book Department, 6, Farringdon Avenue, London, E.C., by remitting the published price and cost of postage.]

A PRACTICAL TREATISE ON MODERN GAS AND OIL ENGINES. By **FREDERICK GROVER**, A.M. Inst. C.E. Second Edition. Price 4s. 6d. The Technical Publishing Company, Limited, 31C, Whitworth Street, Manchester.

The enormous spread of the utilisation of gas and oil as sources of motive power during the past fifteen or twenty years, has led to the production of several volumes dealing more or less completely with this branch of engineering. One of these books, written by Mr. Frederick Grover, is at present before us, and we have but little difficulty in forming a favourable opinion as to its merits. Not only are the constructional features of the various commercial types of modern gas and oil engines clearly described and illustrated, but the theoretical principles underlying each type are entered into and discussed. There are several very useful and well-written chapters, too, on such important matters as the arrangement of the engine room, self-starting attachments, testing the power and efficiency of engines, the practical analysis of coal gas, the design and proper proportions of engines, producer gas, &c. These subjects have been dealt with very fully, and in such a way as to render the information of direct practical value to those who design and make gas and oil engines, as well as to those who use them. The portion of the book devoted to testing, describes in detail the apparatus required, and the calculations necessary to make a complete gas engine trial, and this is followed by an account of an interesting

series of experiments made by the author to determine the effects of the products of combustion when present in explosive mixtures of coal gas and air. The book contains over 250 pages and 120 illustrations, and is neatly and strongly bound. It is already in its second edition, and will doubtless meet with the continued success it deserves.

MACHINE-SHOP COMPANION. By **WALLACE BENTLEY**, A.M.I. Mech.E. Price 1s.; postage 1d. The Bentley Publishing Company, Crossley Street, Halifax.

This is the latest work from the pen of Mr. Wallace Bentley, and the title is amply justified by the nature of the contents. The arithmetic and mensuration necessary for making simple workshop calculations are clearly explained in the opening pages, and the rules here given are subsequently applied to such every-day problems as finding the speeds of belt pulleys, toothed gearing, the proper sizes of keys, speeds of milling cutters, &c. There is a very clear explanation of screw-cutting and how to calculate the change-wheels for various pitches, and also a number of useful tables of sizes of bolts and nuts, Whitworth standard threads, speeds of lathes, proper cutting speeds for various metals, weights of materials, tempering colours for tools, areas and circumferences of circles and squares, and square and cube roots of numbers. Some illustrated descriptions of modern machine tools, and a collection of practical workshop notes and receipts, go to complete a pocket-book which should be of constant value as a reference book to every mechanic and engineering apprentice. The volume is very convenient in size, and is strongly bound in a neat limp cloth cover.

CENTRIFUGAL PUMPS, TURBINES, AND WATER MOTORS. By **CHARLES H. INNES**, M.A. Second Edition. Price, 3s. 6d. The Technical Publishing Company, Limited, 31C, Whitworth Street, Manchester.

The subject indicated by the title of this work is one which is usually dealt with but scantily in text-books on mechanical engineering, and hence the volume under notice has ample justification for its existence. It enters very fully not only into the theory of hydraulics, but into the details of construction of hydraulic engines, turbines of various kinds, centrifugal pumps, and impulse water motors, such as the Pelton water-wheel. A chapter which is of especial interest at the present time, and one which we know will appeal to many of our readers, is that dealing with steam turbines, in which the Hon. C. A. Parson's well-known turbine is very fully described and illustrated. Chapters on ventilating fans, hydraulic works at Niagara, and hydraulic buffers, help to make complete what must be regarded as a very valuable and well produced treatise.

MARINE ENGINEERS: AND HOW TO BECOME ONE. By **E. G. CONSTANTINE**, A.M.I.C.E., M.I. Mech.E. Price 5s. The Technical Publishing Company, Limited, 31C, Whitworth Street, Manchester.

Judging by the number of enquiries we get from readers of our paper as to the qualification and duties of a marine engineer, we feel sure that this book must be in considerable demand. It deals thoroughly with the career of a marine engineer from his early school training up to the time when he is a duly certificated engineer, keeping regular watch on an ocean going vessel. The successive chapters are devoted to scholastic education, apprenticeship, scientific education, journeyman engineers, history of the marine engine, development of the marine boiler, water tube marine boilers, junior seagoing engineers, keeping watch at sea, boiler management, breakdowns at sea, Board of Trade certificates, examinations, etc. Although it does not pretend to be a text-book of

marine engine construction there is a large amount of useful information relating to the various types of engines and boilers in use on board ship, and also a number of excellent illustrations. The chapters on repairing breakdowns at sea are of a very practical character, numerous instances from actual experience being quoted and explained. The book right through is written in a very readable style, and the occasional chatty yarns of engineers' adventures at sea, pleasant and otherwise, form very acceptable and instructive interludes to the purely technical matter. In conclusion, we know of no better book to give the would-be marine engineer an accurate insight into the duties and prospects of the calling he is about to enter, and to show him how to achieve success therein. Even the "second" with a "ticket" will find he can learn something from its pages.

The Editor's Page.

A GLASGOW reader, "J. A. W.," writes us as follows:—"The prize you offer for the best design for a model locomotive is altogether inadequate for the amount of work entailed. On making enquiries amongst some draughtsmen, I found that twenty guineas would be considered a small enough price to get. Had you offered a diploma or medal there would be some good work sent in for the competition, but the sum of a guinea is inadequate remuneration."

Although we think our correspondent in his criticism takes rather an unfair view of the conditions of the competition referred to, we believe his letter to be a *bona-fide* expression of opinion, and as such we are glad to have it. When he argues, however, that a professional draughtsman would require twenty times the sum we offer to prepare the required drawings, it is evident that he misses the point of the competition altogether. The competition is intended for amateurs who design and make model engines as a hobby—i.e., for the sheer pleasure obtained from such designing and making, and not with any idea of monetary gain. With a worker of this class the value of a prize won in competition takes quite a secondary place in comparison with the honour and distinction of having done better work than any of his fellow-competitors. We cannot, of course, prevent a professional draughtsman from competing, but then it is at once obvious that the value of the prize would not be sufficient to tempt him to enter with a view to making a profitable use of his spare time. He would have to do the work as much for the love of the thing as any amateur would do. Moreover, the essentials of model locomotive construction are so different from the real thing that a professional engineer would find considerable difficulty in preparing a really satisfactory design, unless he too had made a hobby of the subject.

The foregoing remarks will serve to indicate the reasons which prompted us in fixing the value of the prize at a guinea, but we are quite willing to increase this offer if we are convinced that by so doing we shall ensure a larger number and better quality of entries. We are also agreeable to consider the advisability of award-

ing medals and diplomas in our competitions, instead of money prizes, but we should require in the first place to be assured that such a step would be popular with our readers. In some of our earlier competitions we have given the prize-winners the choice of money, books, apparatus, or tools, and it has been invariably the case that the money has been preferred. We invite correspondence on the above matters from those interested in the locomotive designing competition announced in our last issue, and will see what we can do to meet the wishes of the majority.

"A. E. F." (Birmingham) writes to ask if we can reprint the numbers in Vol. I of THE MODEL ENGINEER. We are sorry that we do not see our way to carry out our correspondent's wishes in this matter, as the difficulties in the way would be very great. Some of the articles from Vol. I, however, will be re-printed in those volumes of THE MODEL ENGINEER series of handbooks for which they are suitable. We would recommend this reader, and others in want of 1898 numbers, to watch our Sale and Exchange Column, as copies are occasionally advertised for sale therein.

The Third Edinburgh and Mid-Lothian Annual Competitive Industrial Exhibition will be held at the Waverley Market, Edinburgh, from the 11th to the 14th of October, inclusive. There are a large number of prizes offered for the best exhibits in the various sections, and amongst the classes open to all comers we may specially mention those for model engines, model steamships, model sailing ships, model yachts, electric appliances, mechanical inventions, lathes, plumbers' work, tin, iron and steel articles. Three prizes are offered in each of these classes—in addition to several special prizes, medals and diplomas for exhibitors gaining most marks in certain groups of classes. Those of our readers who would like to enter models for competition may obtain full particulars from Mr. A. T. Hutchinson, 7, North St. Andrew Street, Edinburgh. Mr. Hutchinson asks us to state that though the ordinary closing date for entries was fixed at September 23rd, he will keep the list open specially for MODEL ENGINEER readers up till October 2nd, and in view of the large number of prizes offered he hopes to secure a good show of models. We are further informed that the North-Eastern Railway will run an excursion train from Leeds, calling at intermediate stations, on Monday, October 9th. Intending competitors travelling with the excursion can rely on their exhibits being received that day.

"An Amateur Canoeist" (Brixton Hill) writes:—"As the winter approaches, could you not use the space vacated by the model yachting race reports, by inserting canoeing matter? Besides the existing canoeists, I believe a good number of model engineers would take up this healthy, exciting, and noble, but neglected, sport. Model engineers would most likely prefer to build their own 'poor man's yacht.' Here they would have an advantage over other amateurs, as they have a knowledge

of woodwork and naval architecture, and would be able to make the necessary metal fittings, to say nothing of their possessing the special virtue of patience."

While we appreciate the interest in our journal which the above correspondent shows in making this suggestion, we regret we do not see our way to take up the subject of canoeing in our pages. Model yachting has a legitimate claim to be included in our scope, as it involves model-making, and further many of the model yacht clubs include members who make and run model steam and electric launches. But canoeing is something of quite a different order, and we must suggest that "An Amateur Canoeist" prefers his request to the Editor of another journal.

The following interesting letter recently reached the Editor from a reader in Merlo (Argentine Republic): "Permit me to add to the list of names from outlandish places as a reader, and a very interested one, too, of your excellent paper. I have just gone through the July number (No. 19). I have all the numbers from January, 1899, and have ordered through an agent in Buenos Ayres all the back numbers. I am very pleased to notice your remarks *re* 'Page for young engineers and electricians' in No. 19 ('The Editor's Page'). As I have never been in a workshop of any kind, I am of opinion this will come as a blessing, at least to one of your readers, and anxiously await my copy for August, No. 20. Of course, home readers have everything at hand, and what they have not got, it is easy for them to purchase. Myself out here (where I am the only Englishman at this place, Merlo) find difficulties on all sides; for instance, I have gathered together by degrees during eleven years in this place a considerable number of tools, but I have no kind friend handy to give advice. I am looked upon here as the Jack-of-all-trades for the little town, whose neighbours come to me for every little job, from clock repairing, tinkering, accordion and guitar repairs—in fact, all kinds of odd jobs I am called upon to do. I have made an electric alarm, a small model six-wheeled loco. (cylinders from two brass cartridges), electric motor, electric bell—in fact, a whole host of different kinds of articles, but the great difficulty I experience is the want of material, as all the work I do is from scraps and any old and odd stuff I manage to pick up. I envy home readers, as they are able to purchase whatever little items they are in want of, and from the varied assortment of lists and catalogues advertised in THE MODEL ENGINEER, I hardly think they can go short of anything."

On account of the great pressure on our space in this issue we are obliged to hold over the continuation of the article on "How to Start a Workshop" till next month. We, however, publish a very useful article on making a simple form of lathe at home, which we think will be of use to those beginners whose stock of tools is limited.

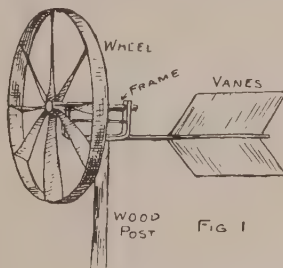
Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.]

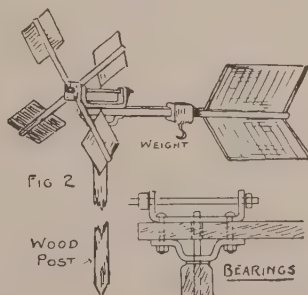
Small Wind-Motors.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Perhaps a few words on small wind-motors may be of interest, although the writer has never actually fitted one up for useful work; small wind-motors make pretty models, and are very easily made. The diagrams will explain themselves:—Type No. 1 is suitable for motors up to, say, 18 ins. in diameter; the wheel and directing vane are made of thin sheet metal; the wheel is cut from a circle; then the blades are cut and bent to the

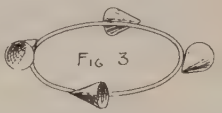


proper shape, *i.e.*, each one given a twist in the same way (like a screw propeller, &c.). The framework is cut from metal and soldered together. For larger motors two wooden crossbars are bolted at right angles, a spindle is driven in and sheet tin sails are nailed to these bars, and are then bent; the framework can be wood or metal, and the vane may be thin wood or a wire frame with strong cloth sewn on (Type 2).



Another type has hollow cups or cones soldered on to a light wheel which runs on a vertical shaft; of course, this type needs no directing vane to make it face the wind (Type 3). This never seems to be used in actual practice. The writer's largest was Type 2—wheel about 5 ft. in diameter, four sheet iron sails of about 1 ft. square each; the vane was iron wire covered with strong canvas. His smallest (Type 1) a ferrotype iron wheel about 1/2 in. in diameter; vane of the same metal, and framed of thin brass. The larger motors must be strongly made, and

the heavy wheel should be balanced by a weight put on the vane end. For practical work a turn-table is required,



and a bevel-gear (or crankshaft, in the case of a pump being driven). The wheel is best of the usual American type, built up like Type 1.—Yours truly,
Weston-super-Mare.
R. F. M. W.

Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) Stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.]

The following are selected from the queries which have been replied to recently:—

[1364] **Lacquering Model Engine.** P. T. R. (Bristol) writes:—I have just built a small engine from brass castings, and I should be most obliged if you would kindly tell me the best way of lacquering it.

Carefully polish all parts to be bright, taking care to get no finger marks on them. Warm the parts until they are just too hot to be comfortably held. Apply the lacquer by means of a large and very soft brush, going in one direction only and taking care not to go over the same part twice—a second coat, if necessary, should be given when article is thoroughly dry. Dry off in a warm oven for a few hours. Brass lacquer is best bought ready made. The following is formula for its composition:—3 ozs. of shellac, 2 ozs. of sandarach, 2 ozs. of annatto, $\frac{1}{2}$ oz. of dragon's blood resin, 1 gallon of spirits of wine; or, 8 ozs. of shellac, 1 gallon of spirits of wine.

[1366] **Windmill to Drive Dynamo.** M. R. M. (Lynn, Cheshire), writes:—Having constructed a small windmill, eight arms 12-in. long, 3 in. wide, I now desire to apply it to some useful purpose. It occurred to me that I might drive a dynamo from the windmill from which I could charge accumulators, the current from which I could use whenever necessary. Relative to this idea I should be glad if you would answer for me the following queries: (1) Will a dynamo work effectively with its spindle vertical? (2) If, when the accumulators are nearly charged, the windmill stops, but is prevented from rotating in a reverse direction by means of ratchet and pawl, will the current from the accumulators flow through the armature, or will the magnetic lines of force from the field-magnets act as a brake on the current? (3) Will the dynamo work efficiently revolving, as it must do, at varying speed? (4) What would be a convenient size of dynamo for this purpose? I should prefer to have full details of this as I wish to make the machine entirely myself. The dynamo should be compact, as it is to be at a considerable distance from the ground. (5) Will the working of the dynamo be effected by being enclosed in a cast iron casing? (6) What size of accumulator could be charged?

(7) There is no reason why a dynamo should not work effectively with the spindle vertical. (3) Yes, if the dynamo fails to generate a current sufficiently powerful to overcome the accumulators, these will discharge themselves back through the dynamo. To prevent this, automatic switches are used, and a simple form of this was illustrated on page 100, May 1899, **MODEL ENGINEER**, in reply to query 945. (3) The dynamo will only charge at or above a certain speed. If this correct speed is much exceeded the current would be too great for accumulators. A governor might be used to regulate the opening of the sails of your windmill and keep speed steady. (4) As the greatest h.p. your windmill can develop in a twenty-mile breeze is about 1.50th, only a very tiny dynamo—a toy, in fact—could be driven by it. (5) Not if the cast iron casing is fairly large compared with dynamo. (6) From (4) it will be seen that no practical work could be done by dynamo.

[1335] **Coil for Wireless Telegraphy.** W. A. C. (Bath) writes: I have read with interest your answer to 1007 on Wireless Telegraphy for a distance of about 100 yards. (1) Would you kindly let me know what size of coil should be used instead of a Wimshurst? (2) What number of cells, etc., would be required to

work it? (3) How could I manage to send the message to a particular receiver if there were more than one within the distance (100 yards)? (4) What alteration would be required for about 400 yards? (5) Would intervening buildings hinder message?

(1) A coil can be used instead of a Wimshurst, and is generally employed. In using the coil you will require a tapping key, and the coil must be connected to the transmitter balls with a Leyden jar in parallel circuit. (2) The size of the spark given by the coil, and the number of cells to be employed, will depend upon the distance to which the message has to be sent; for 100 yards a 1 in. spark coil would be ample, but the spark between the transmitter balls would not require to exceed $\frac{1}{4}$ in. As the distance between the transmitter and receiver increases, so may the length of this latter spark. (3) By placing behind the spark gap of the transmitter balls a polished metal reflector made somewhat in the shape of the letter V, which shall reflect the waves in the direction of the particular "receiver" you wish to actuate. This, however, will hardly be necessary unless you have other receivers round about you. (4) The only difference you need make will be to increase the length of the sky-pointing rods in both transmitter and receiver. (5) No.

[1374] **H.-P. Vertical Boiler.** H. N. I. (Mortlake) writes:—Please could you tell me how to make a $\frac{1}{2}$ -h.p. steam boiler, vertical type? I want to make it out of sheet iron. What would be the thickness of iron, etc.? I want to make it as simple as possible.

Make the boiler of $\frac{1}{4}$ -in. sheet iron, 9 in. diam. by 18 in. high; firebox, 8 in. diam. at bottom, 7 in. at top, 9 in. high; of 3-16ths in. copper; crown plate of boiler 2 in. thick; of firebox 1 in. thick. Use a single uptake through the boiler of $\frac{27}{32}$ in. diam. seamless copper tube, $\frac{1}{2}$ in. thick. Otherwise follow the arrangement of boiler in query 1185, July issue, except again that you will not require the smokebox space at top. Rivets, $\frac{1}{4}$ in. iron; $\frac{1}{2}$ in. centres. Boiler pressure, 45 lb. to square inch.

[1376] **Electric Ignition for Oil Engine.** C. W. (Notts) writes:—I have under my care at the present time a Priestman Oil Engine with electric ignition. The spark is produced by a large induction coil, and worked with a quart chromic acid cell. Judging from the size of the coil, it ought to give about an inch spark; but we very often have some trouble in getting a good thick $\frac{1}{2}$ in. spark. We have to charge up the cell now about every twenty-four hours, sometimes often. So for that reason I consider it troublesome, dirty, and expensive, so that I should be glad to know if there could be a compound dynamo running continuously about 400 yds. away? If an accumulator would be cheaper, please say what type and size would be most suitable? Suppose a small dynamo (say about 25 watts) were mounted on the engine bed, and driven from the engine by a small belt, would it not be cheaper than either battery or accumulator?

I think you cannot possibly do better than to obtain from Mr. F. C. Blake, Ravenscroft Works, Dalling Road, Hammersmith, a pair of his 35 ampere hour accumulators, and charge them from your dynamo. These cells would require a charge of 5 amperes, passing for seven hours for charging them. Of course, you should have a spare set charging whilst the others are in use. A pair of these cells operating a 5 h.p. engine, which makes 120 revolutions per minute, and which runs fifty-four hours per week, lasts, with one charge for four weeks. Cost of charging, about 6d. each if sent out to be charged. We understand that Mr. Blake is placing on the market a small magneto dynamo, specially arranged and self-governed to work his coils, and we really think you would do well to communicate with him on the subject.

[1377] **Dynamo and Engine Coupled Direct.** H. E. S. (Taunton) writes:—Could you kindly let me know if the following could be accomplished? I have a $\frac{1}{2}$ b.h.p. oil engine as my power, and a dynamo. I want to drive couple it to my engine shaft and I want to get 22 volts 10 amperes at a speed not exceeding 465 revolutions, the speed at which the engine runs when fully loaded. The dynamo in question is an overtype, all of cast iron. It has a drum armature, and the core plates are cast in one piece, and which run fifty-four hours per week, lasts, with one charge for four weeks. Cost of charging, about 6d. each if sent out to be charged. We understand that Mr. Blake is placing on the market a small magneto dynamo, specially arranged and self-governed to work his coils, and we really think you would do well to communicate with him on the subject.

It would be practically impossible to get to 465 amperes at 22 volts at a speed of only 465 revolutions per minute without re-winding the armature, and then it is very doubtful whether you could compass your end. As you do not state the number of revolution-at-present required, nor its present output as a dynamo, it is absolutely impossible for us to calculate the alteration in winding necessary to generate the desired current at the lower speed. But you can calculate this out yourself if you will run the dynamo up to such a speed as shall cause it to give the desired 10 amperes at 22 volts, and note the number of revolutions.

Divide the number by 465, the quotient will represent how much longer the wire on the armature must be to give the same voltage at the lower speed, and you must choose a wire for re-winding the armature, the section of which is as many times less as its length is greater than that actually on the armature. You will find these data in almost any copper wire list. This decides the winding of the armature. Now for the field-magnets. Having noted the entire resistance of the total amount of the proposed wire on the armature,

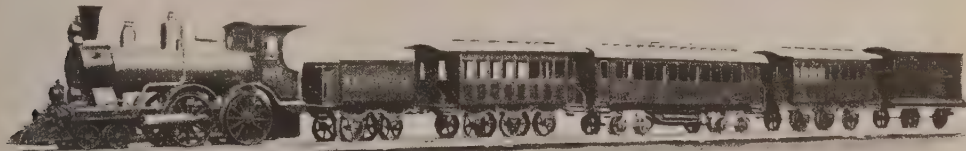


FIG. 1.—MODEL AMERICAN PASSENGER TRAIN.

divide this by four, which gives the running resistance; multiply this latter by 400 for the resistance of the shunt coils, which should be, in wire four numbers higher than that on the armature. Again, to get the series coils resistance, you will multiply the running armature resistance as obtained above by 0.66, and this will give you the correct data for winding your machine as a compound.

Amateurs' Supplies.

[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.]

New Model Engine and Electrical Lines.

A set of fittings and parts for model engine construction has been sent to us by Messrs W. J. Bassett-Lowke & Co. for our inspection. No amateur could view the selection of fittings without being guilty of covetousness, for these parts are of high-class workmanship and smart, practical design. They will appeal to every class of mechanical amateur, whether he be interested in locomotives, marine, stationary engines, electrical matters, or in other model work. Especially to be recommended are the new patent "Perfect" cylinders, which are well made, nicely lagged with thin sheet iron, and beautifully finished, all bright parts being nickel-plated and polished. Each cylinder is finished complete, being provided with piston and connecting rods and a clever slide-valve, and, judging from the sample sent, works easily and with a minimum of friction. In addition these slide-valve cylinders appear to be very little—if any—higher in price than the ordinary oscillating cylinder. Amongst numerous other items we may note some excellent examples of well-made bolts and nuts, a very neat and small pressure gauge, and

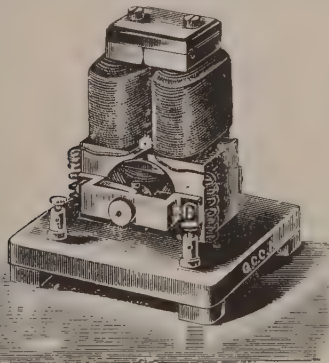


FIG. 2.—MODEL ELECTRIC MOTOR.

ocomotive wheels and parts. Some of the latter are used in the construction of the model American loco. shown in the accompanying illustration (Fig. 1), which will give some idea what Messrs. Bassett-Lowke can accomplish in the model line. It is stated that the train, as illustrated, can attain a speed of ten miles an hour, and it is certainly a

very realistic model of an American passenger train. Electrically inclined readers will also find Messrs. Bassett-Lowke & Co.'s catalogue of absorbing interest. We illustrate a good type of self-starting motor, with tripolar armature (Fig. 2), suitable for working from two bichromate cells, and which is of efficient design. This is only one of a large number and assortment of dynamos and electric motors. The other illustrations show a model arc lamp (Fig. 4) and stand for small incandescent lamp (Fig. 3) respectively, both moderate in price and

effective looking. We can safely recommend our readers to send to Messrs. Bassett-Lowke & Co., Kingswell Street, Northampton, for their catalogue of models and parts, the price of this list being 4d.



FIG. 4.—MODEL STAND FOR HOLDING SMALL INCANDESCENT ELECTRIC LAMP.

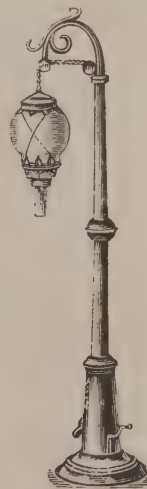


FIG. 3.—MODEL ARC LAMP.

It is further announced that all readers of *THE MODEL ENGINEER* will be allowed a special discount of 10 per cent. on articles purchased before November, 1899.

Electrical Novelties.

Our last issue contained a notice of some clever electrical novelties by an American firm—the Elbridge Electrical Manufacturing Company, of New York. We are informed by Messrs. Field & Co., 46, Clerkenwell Road, London, E.C., that they have taken over the English agency of the Elbridge firm, and we draw our readers' attention to this fact.

Model Steam Hammer Castings.

We have received for notice a set of brass and gunmetal castings for a steam hammer, similar to that described in the June issue of *THE MODEL ENGINEER*, but of half the size. The cylinder, covers, steam chest, etc., are in gunmetal, and the rest of the castings, with the exception of the anvil block, which is of iron, are brass. A departure is made from the design given, in having the standard cast in four parts, which can easily be bolted together with a little expenditure of time. This is necessitated by the low price asked for the set. The maker states that all parts are cast under his supervision, and the specimens before us are clean, smooth castings,

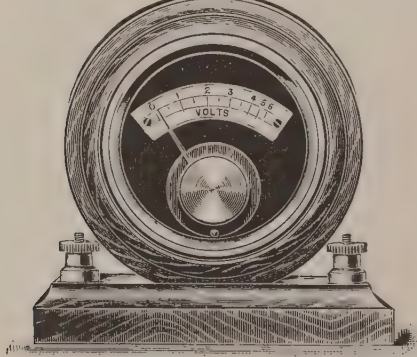
with no flaws visible. They have already given great satisfaction to purchasers, and all particulars will be readily supplied on application to Geo. Goodman, East Hayes, Bath.

Model Boiler Fittings.

Every amateur who cares for his art appreciates good fittings with a high finish, but values above all correct up-to-date designs, embodying the best modern practice in engineering work. Mr. Bertrand Garside is a model maker who keeps right up to the times, as is evidenced by a set of fittings submitted to us, and by his new catalogue of general engine and boiler parts. Newest of all is a perfect little wheel-valve, which will undoubtedly fill a blank in the model-making world. Other good things are gunmetal water gauges, solid drawn seamless copper tubes for boiler making, up to 8 in. diameter, and taper-pointed, snap-headed rivets. These latter have a very professional appearance, and are sold at an extremely low rate. Mr. Garside is also supplying a two-cock lubricator, made of gunmetal, in several sizes, which has a neat appearance, an injector for models and small-power boilers, materials for constructing boilers, and the complete finished article, besides all fittings. Readers will find the catalogue of great interest, as it is well printed and all the illustrations are prepared from photographs of the actual goods. The list will be sent to readers on receipt of two penny stamps by Bertrand Garside, Modeller, Warrington.

Electrical Measuring Instruments.

The low-reading voltmeter we illustrate herewith—one third actual size—will have strong claims on the amateur's attention, as it is well made, reliable, and very moderate in price. The maker states that each instrument is separately calibrated and the scale engraved accordingly, so that every instrument is exact in its readings. The volt-



meter is of the gravity control type, specially intended for measuring the E.M.F. of batteries or small dynamos. It is being introduced by Mr. W. R. Morris, of Faraday Works, Henrietta Street, Birmingham, who is also maker of similar types of ammeters and combined instruments as well as electric measuring instruments generally. Full particulars and prices will be supplied to readers on application.

A Small-power Oil Engine.

Messrs. Butler Bros., Engineers, Dale Works, Derby, in sending particulars of a new oil engine they are introducing to meet the requirements of model engineers, state that it has the advantage of using one oil only to both work the engine and heat the ignition tube and vaporiser. The oil for the vaporiser is drawn from the cylinder oil tank on each suction stroke of the piston by means of a special regulator, which causes a minute quantity of oil to be vaporised and mixed with air to form the explosive charge. This mixture of oil vapour and air can be regulated to a nicety, and the engine thereby run either at full speed or at a few strokes per minute, as required. The cylinder has a bore of 1½ in. and a 2½ in. stroke, and the full speed is 500 revolutions per minute. The engine consumes only 4 pint of oil per hour at full power. Prices and full particulars can be obtained from Messrs. Butler Bros., as above.

Bench Lathe Castings.

A cheap set of bench lathe castings can be obtained from Mr. W. Hanson, of Queens Crescent, Haveringstock Hill, N.W., the set consisting of lathe bed, driving pulley, poppet head, two standards, three clamp attachments with nuts, faceplate, headstock, tee rest, and tee. Height of centres is 2½ in., and length of bed is 24 in. It is stated that the castings are clean and fit together easily and with little labour. Particulars of these sets, as well as castings for slide-valve cylinders, cranks, pumps, and other engine fittings, can be obtained by MODEL ENGINEER readers on application.

Catalogues Received.

Stevens' Model Dockyard, 22, Aldgate London, E.—Pending the issue of their new and enlarged catalogue, this firm have brought out two new lists—one of eight pages, dealing with model engine and boiler fittings, and the other of four pages, devoted to model yacht fittings. In each of these lists every article priced is illustrated, so that the purchaser has a representation of the goods before him when making his choice. The engine list deals with loco, marine, and stationary engine parts and fittings—including such details as chimneys, domes, springs, safety-valves, regulators, water-gauges, axles, driving-wheels, flywheels, taps, lubricators, propellers, paddle-wheels, governors, crankshafts, pumps, etc. The model ship list gives illustrations and prices of anchors, rudders, compasses, ventilators, boats, flags, blocks, davits, guns, figureheads, ship lights, buckets, engine-room telegraphs, spurs, etc. Both lists will be sent free to any address on receipt of a post card.

H. F. Harding, 303, Brixton Road, London, S.W.—This is a list of rough and finished motor cycle parts and castings, which should interest those of our readers wishing to build a motor cycle. Mr. Harding undertakes any kind of machine work connected with motor or cycle making, and also does experimental work and pattern making. The list will be sent free on application.

T. M. F. Tamblin-Watts, Goldlands, Settle, Yorks.—This is a particularly useful list of electrical apparatus, suitable for amateurs and students interested in experimental work. In addition to a good range of bells, telephones, batteries, switches, and electric light fittings, there are particulars and illustrations of a number of good types of laboratory measuring and testing instruments and lecture appliances. On page 20 we note a useful price list of the various metals required for conducting electric and magnetic experiments, and again on page 44 a well arranged table of electric wires, giving size, resistance, and price in a very convenient way. The combined tangent galvanometer and magneto-meter illustrated on page 47 is also well worthy of attention. The utility of the list is increased by concise explanations of the abbreviations and terms used therein, and some useful tables of electrical information. The index too is very complete. The list covers 54 pages, and is well worth the 6d. which it costs.

Brewster, Smith & Co., 6, Cross Street, Finsbury Pavement, London, E.C.—This firm have sent us a very comprehensive catalogue of scientific apparatus, suitable for technical students and amateurs. It covers over 200 pages, and deals chiefly with chemical apparatus, but also includes thermometers, vacuum, and x-ray tubes, glass models of pumps, &c., galvanic electric sets, blow-pipe outfits, and induction coils. The price of the complete list is 1s., but the firm also issue a separate electrical list, post free, 3d.

F. & H. Shaw, Limited, Hedden Bridge.—The latest addition to this firm's catalogue are illustrated sheets dealing with lathe chucks, of which a number of very useful patterns are shown. These range from small drill chucks up to large 4-jaw chucks, suitable for heavy work.

W. Martin & Co., Albion Works, East Road, West Ham, London, E.—The ninth edition of Messrs. Martin & Co.'s well-produced catalogue is just to hand. This includes the usual range of accurate scale models of well-known types of locomotives, and in addition gives particulars of a new set of castings for a ½ in. scale model of a Caledonian four-coupled express loco. The list will be sent to any reader in the United Kingdom, post free, for 5d., or will be mailed free anywhere abroad.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. If remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All correspondence relating to advertisements to be addressed to the ADVERTISEMENT MANAGER, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All subscriptions and correspondence relating to sales of the paper to be addressed to the publishers, Dawbarn & Ward, Limited, 6, Farringdon Avenue, London, E.C.

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**My Model Electric Tram-Car, and
How I Made It.**

By F. SIMPSON.

BEFORE I describe my model I should like to state that all the work was done with the ordinary tools to be found in a house. The tools I used were the following: 1 hammer, 2 files (1 flat and 1 three-corner shape, and about 6 ins. long), a prickler, which I used as a drill, a screw-driver, soldering iron, pair of pincers, pair of pliers, compasses for circles and for measurements, and a fret-sawing machine also made by myself. For an anvil I used a boot-repairing last. I ought also to mention that I used a special sort of oil for soldering, known as the "Pioneer" soldering oil. Before I used this oil I could never make a good joint, but with it I can always make a good and secure joint. I am a warehouseman by trade, and cannot be said to have had any practical instruction in this sort of work beyond what I have got from reading and studying books. The MODEL ENGINEER in particular has been a great help.

The body of the tram-car shown in the photograph is made of fretwood. The sides are cut in one piece, the openings for windows, &c., being cut with the fret-saw. The ends of the car were made in the same way. The sides and ends were cut out of 3-16ths in. wood, and the glass for windows was put in

frames on the inside of the car. The top is made of 1/4-in. wood, as is also the bottom of the car and the bottom of the platform. The seats, both inside and outside, were cut from 1/4-in. wood, the frames for the chairs outside being made of strip iron 1/4 in wide. This strip iron is the kind used by bent-iron workers. The backs of the chairs were made movable.

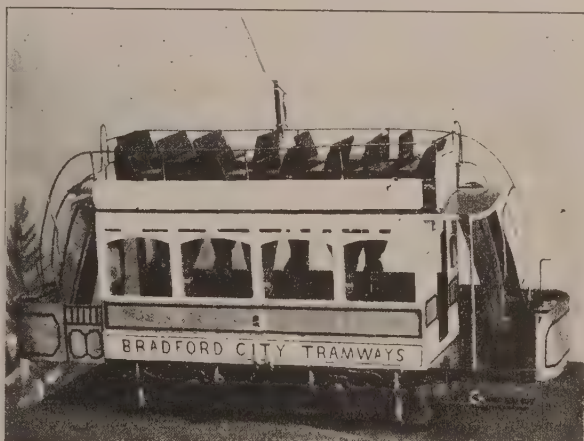
In constructing the chairs I had to bore no less than sixteen holes for rivets and screws in each chair, and as there are fourteen chairs it was no small matter to drill all these holes by hand. Of course, it may be said I should

have bought a drill, seeing that they are so cheap, but I have made a practice of using the tools I had by me, just to show some folks that where there is a will there is a way.

But to get back, the truck, wheels, and cow-catchers underneath the car were cut out of 1/4-in. wood. The cow-catchers are fastened to the truck by hinges and held up by springs, as shown in the photograph. The springs are made out of brass wire, and were made by hand. The axle boxes are dummies, as the bearings for the axles are plain pieces of

3/8-in. brass with hole drilled in to take the end of the axles.

Inside the truck are fixed the motor, electric bell, and electric brake. The motor is one I designed myself and consists of magnet made out of 1/4-in. by 2-in. iron bar about 8 ins. long and forged to the shape of a horseshoe and wound with about 1/2 lb. of 20 D.C.C. wire. This magnet took me eight hours to make, and was forged



MODEL ELECTRIC TRAM-CAR.

and heated at home. The armature is $1\frac{1}{4}$ ins. diameter by 2 ins. long, and built up of stampings and wound with 3 ozs. of No. 26 D.C.C.

The commutator is made out of fibre and is disc type. It is also fitted with brush rocker made of fibre.

The motor is connected in series. The gearing is double reduction, *i.e.*, small wheel on armature shaft engaging with large wheel on intermediate shaft, and intermediate small wheel into large wheel on the car axle. The wheels of the car are 3 ins. in diameter.

I need not describe the bell, as this is made in the usual way, the only difference being that the mechanism is placed inside the gong instead of being in a box. I adopted this sort of bell because it takes up rather less room.

The brake is made of $\frac{1}{2}$ -in. iron bent to horseshoe, and wound with 2 ozs. of 22 D.C.C. wire. On the brake blocks (which are of wood) I fastened the armature, which almost touches the magnet. The action is thus: when I place the brake-switch on, it energises the magnet and attracts the armature and pulls the blocks up against the wheels.

The wheels of the car are plain pieces of wood, and were cut to a circle with the fret-saw and are not flanged. The rails on the top and down the steps were made from No. 16 copper wire, bent to shape and soldered to steps. The steps are made of tin, riveted first, and then bent to a slight turn and soldered. The rod shown at the front of platform was made from No. 8 brass wire, and is fastened to top of car and bottom of platform and outside step. The ends of the platform are of tin, with a No. 18 iron wire run in at the edge, and are bent and fastened by screws to end of car and bottom of platform.

The switches are eight in number, four at each end of car, and comprise main reversing switch, foot-push which rings the bell, conductor's switch (also rings the bell), and brake switch on the top of main switch. The main switch is shown in front, and has a long copper handle, and the conductor's switch is shown just over the little window and up the side of doorway.

The enamel I used for this model is known as "Victory" Enamel. The colour of the truck is chocolate with black lines; next above the truck is white with chocolate lettering and lining. The portion above, again, is royal blue with vermillion lines round the edges, and has "No. 1" and the coat of arms in white, vermillion, and blue. Above, again, is all white. The end of the platform is in blue with vermillion lines; the chairs are plain varnished with the frames in black; the main switch boxes are in chocolate with white lines. I may say that I did not use a brush for the lettering and lining. I used, instead, a pen used by draughtsmen for inking in drawings, and found that I could make in this way a very neat line.

I will now describe the way the car is made to run. On the side of the car will be seen two terminals; these I use when I want to make the car run up the street or anywhere where I cannot fasten the poles. The way I do this is to connect about 20 yards of covered wire to these terminals and put the battery in the middle, and then let the car run till the wire gets tight. I then reverse it, so that in reality it runs about 40 yards. When I use the poles (which are made out of $\frac{1}{2}$ -in. bore copper pipe and made fancy to imitate the originals) I fasten one wire to the bottom of one pole and the other wire is fastened to a strip of wood, which is screwed to bottom of pole. Of course, I have the overhead wires between the poles, and the trolley wheel makes contact with this in the usual way. But you will ask, "How about the return current?" This is how I get over this difficulty. I use a wire running underneath the car, and this wire makes contact with copper strips on the cow-catchers, and so

returns the current to the strip of wood mentioned above, and so to battery.

The battery is the usual form of bichromate $\frac{1}{2}$ -pint size, and I use six connected in series, so that the car takes about 12 volts at 2 amperes. This size of battery will run this car for an hour continuously. The weight of car in running order is $12\frac{1}{2}$ lbs., but it will pull about twice this weight if placed on the top of the car. I have not yet fitted this model with lamps, but I intend to do so at an early date.

This model has taken about a year of spare time to construct, and was made entirely without drawings. The only help I have had was a photo taken by an amateur, and I got all I wanted from this. I am going to make drawings of this model in a short time, and I shall be happy to lend these to any of your readers on condition that they send me stamped directed envelopes. The exact size of the car is, over all, length, 30 ins.; height, $15\frac{1}{2}$ ins. to top rail; width, $8\frac{1}{2}$ ins.

Two Useful Additions to a Screw-cutting Lathe.

By C. E. S.

PART II.

I WILL next describe the appliance used in the self-acting surfacing motion. This consists in a grooved pulley wheel attached to the transverse screw of the slide-rest, and a second one on the leading screw, which can be moved to any convenient place and fixed there. The two are connected by a gut band, which is led into position by a pair of guide pulleys, the latter hanging from

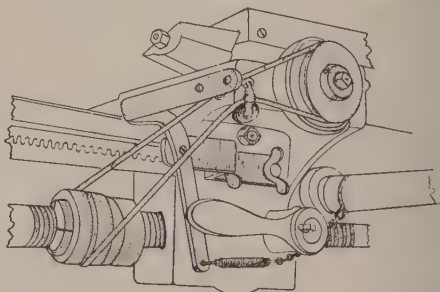


FIG. 1.

an adjustable arm supported by a bracket attached to the apron of the slide-rest. Fig 1 shows the appliance ready for use.

The materials needed are:—Two pieces of flat iron bar, one $\frac{7}{8}$ in. by 3-16ths in. and 7 ins. long, and the other $\frac{1}{2}$ in. by 3-16ths in., and 10 ins. long; a pair of small brass pulley blocks, a pair of iron hooks, a few inches of brass chain, a small coiled spring, 3 ft. of gut band with hook and eye to fit, and a few small bolts and fly-nuts. A simple brass or gunmetal casting will also be wanted to form one pulley wheel, and a few pieces of wood, including a piece of box 3 ins. long by about $1\frac{1}{8}$ ins. in diameter. The whole cost should not exceed 2s. 6d. or 3s. As mentioned in the previous article, the dimensions of the various parts will be those suitable for a Britannia Company's No. 14 lathe, having $3\frac{1}{4}$ in. centres, and 3 ft. 6 ins. bed, but they can be easily altered to suit lathes of another make or size.

The first part to make will be the bracket and arm, to which the guide pulleys are attached. These are shown in Fig. 2. Make the bracket first from the flat iron, $\frac{3}{8}$ in. by 3-16ths in., bending it twice at right angles. The exact distance between the bends is not of great importance, but should be about $1\frac{3}{8}$ ins. for a lathe of 3 $\frac{1}{2}$ in. centres. It must be sufficiently long when the part C is fixed to the apron of the slide-rest to allow A to clear the projecting side of the apron, but at the same time it must have room for manipulating the handle of the leading screw clasp nut. When the self-surfacing motion is not in use, it is simpler to remove the arm from the bracket, and to leave the latter in position, than to detach the bracket from the slide-rest. In C, which is 3 ins. long, two holes must be drilled large enough for $\frac{1}{4}$ -in. bolts to slip through easily, and not placed too near the ends, or space will not be left for the wings of

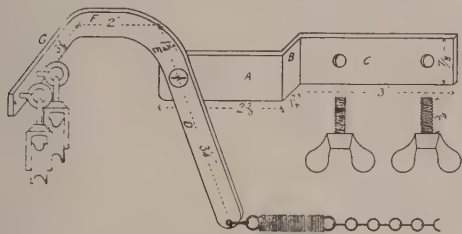


FIG. 2.

the bolts. Make A $2\frac{3}{8}$ ins. long, and $\frac{3}{8}$ in. from the end drill a hole to be tapped for a small bolt.

Place the bracket in position on the apron, and on the latter mark the places for the two bolts, and drill $\frac{1}{4}$ -in. tapping holes. These holes can be made easily with a breast drill, the more so if the pressure of the body is helped with a lever. Place the side, say of a broomstick, against the end of the drill, and with a piece of rope connect one end of the broomstick with a convenient part of the lathe bed or standard, and get someone to press on the other end while you steady and work the drill. Let the distance from the drill to the tied end be about a foot, and you will have plenty of pressure. Tap the holes to $\frac{1}{4}$ in., and make two bolts, as shown in Fig. 2, using fly-nuts as heads.

Next fix the bracket to the slide rest and determine the dimensions of the movable arm. The point to notice is that when the two guide pulleys are in position near the end of the part G, and allowance is made for their being pulled obliquely towards the lathe-bed and slide-rest by the gut band, a line from the pulley on the slide-rest screw parallel to the lathe-bed should pass approximately between them in the vertical plane. The horizontal plane is of little importance, as it varies with the movements of the movable arm; but with the latter in its position in use, as shown in Figs. 1 and 2, the guide pulleys may with advantage hang somewhat below the level of the slide-rest pulley. Further, the length of the part F must be such that with the pulley and the leading screw placed at a convenient distance from the slide-rest, as shown in Fig. 1, the gut may pass from the latter to the guide pulleys obliquely upwards, but at right angles to the lathe bed.

The movable arm is made from the iron, $\frac{1}{2}$ in. by 3-16ths in., and the bend between E and F, which is on the flat, should be made first, by heating and placing the edges of the part F in a vice, and pulling round the end D. Then heat again, and bend G at right angles to F. Drill a small hole at the bottom of D for a split ring,

and another between D and E large enough for a small bolt to pass through. A round-headed stove screw forms an excellent bolt, which the hole in the bracket should be tapped to fit, and, when in position, it should be long enough for a binding-nut to be placed upon it.

The pair of guide pulleys must next be made from the brass pulley blocks and iron hooks. Fig. 3 shows clearly how this is done. The screw end of the pulley is to be removed with hack saw or file, and the screwed and bent ends of the hook cut off, leaving a wing joint. The short end of the latter has a thread cut upon it, and a hole is drilled in the end of the pulley-block and tapped to fit, and the two are screwed together. The inside of the block is then smoothed with a small file. The free end of the hinge should be 7-16ths in. long. Small pulley-wheels of about 11-16ths in. diameter are best, and there must be plenty of space between the block and the wheel for the hook and eye of gut, $\frac{1}{4}$ -in. in diameter, to pass through. This space varies considerably in different makes.

Drill two holes in G $\frac{1}{2}$ in. apart for the pulleys, remembering, in fixing their position, that the pulleys will be drawn inwards by the gut, and let the holes be a loose fit. Place the shanks of the pulleys in position, and, with light blows of a hammer, make heads on them at the back of G. When this is done, they must twist round quite freely. A small coiled spring, such as that used in a spring-balance, is connected at one end to D by a splitting, and at the other to a few inches of brass chain.

We will next proceed to the metal pulley wheel shown in Fig. 4, which is to fit on the screw of the slide-rest. Its diameter is to be the same as that of the pulley wheel on the leading screw, shown in Fig. 5, which is made as large as the distance between the leading screw and

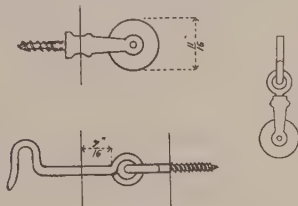


FIG. 3.

lathe-bed will allow; in the case being described each is $2\frac{1}{4}$ in. in diameter. For the slide-rest pulley a casting will be needed, either of gunmetal or brass, preferably the former, as it gives a better grip to the gut-band, and, as is shown in the diagram, there is a bar in the centre. The casting is turned true all over, and a deep acute groove made on its periphery. A central hole is made which will just allow the square end of the slide-rest screw to be inserted. Drill four equi-distant holes through the side of the bars, and tap for 3-16ths-in. screws, which are to fix the pulley to the slide-rest screw. The screws are made of iron rod, such as a large iron nail, and should lie flush with the bars when screwed tight home; with a hack-saw or fine file make a slot in the end of each; let two adjacent ones be a tight, and the other two an easy working fit, and with a centre punch mark the position of the latter on the bars and slide-rest screw. By means of the four screws the pulley is carefully centred to screw true on the slide-rest screw; and, should it be necessary at any time to remove it, this can be done by loosening the marked screws, and it can then be replaced in a moment with the certainty of its still running true. When the self-acting surfacing motion is

not in use the pulley will seldom be found in the way, and it is better to leave it permanently in its place. It may, however, be necessary to shorten the working end of the winch handle.

Next make the leading screw pulley and its fittings, which are shown in Fig. 5, and consist of four pieces of wood—a central cone, terminating in a screw, which is made of box, and upon this the pulley, made of mahogany or pear, and a washer and nut, made of pear. Every piece may be of box, but it is unnecessary.

Mount a piece of box 3 ins. long between centres, and turn the whole down to about $1\frac{1}{4}$ ins. diameter. Then place it in a cup or jaw chuck, and with a drill against the back centre, make a hole right through. A twist drill, free from rust and well lubricated with tallow, will soon pass through, if withdrawn once or twice to prevent clogging. The hole is then enlarged with a boring tool to 1 in., so that it will move easily, but not loosely, on the

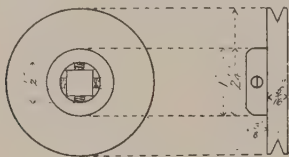


FIG. 4.

leading screw, and this is best gauged by taking down the leading screw and trying the fit with the work still in the chuck.

When bored to right size, turn a wooden mandrel between centres, and mount the work upon it. Turn $1\frac{1}{2}$ ins. of the left-hand end to $5/16$ th in. in diameter, and cut a screw upon it: eight threads to the inch will be found suitable. The remaining part may be turned roughly to form a cone, and then the boxwood on its mandrel laid aside.

Mount a piece of pear in a cup chuck to form the nut and washer, the dimensions of which are shown in the figure. There will be little difficulty in cutting the screw in the nut, as a good piece of pear will give a clean thread, even with a screw tool intended for iron. Use for preference a comb tool held in the slide-rest, but if this is not available a single point tool will do.

Next, get a piece of mahogany cut plankways about $3\frac{1}{2}$ ins. square and $1\frac{1}{4}$ ins. thick, and attach to a face-plate by a carpenter's screw into each corner from the back, after placing between the two a packing of any common wood to work into. Face the mahogany to the proper thickness, and make a hole, say of $\frac{3}{4}$ in. diameter, in the centre, and remove the face-plate, leaving the wood attached. Replace the boxwood on its mandrel between centres, with the screw towards the right, and set the upper slide of the slide-rest slightly out of the parallel. Then turn a cone on the boxwood to the dimensions shown in the figure, making its smaller end of the same diameter as the top of the screw threads. Where the screw meets the cone make a semi-circular recess, as shown in the diagram, leaving the wood a small $\frac{1}{2}$ in. thick at the bottom. Fix a pencil in the tool holder of the slide-rest, and put a change wheel with thirty or sixty teeth on the mandrel, and using this as a division plate, mark six equi-distant lines down the cone just formed. Remove the work, and bore six $\frac{1}{2}$ -in. holes in the semi-circular recess, one at the end of each pencil line. Saw off one end of the mandrel flush with the cone, and with the other end fixed in a vice, make three saw cuts as accurately as possible down the pencil lines, so that they end in the six holes, and take out the mandrel.

Replace the face-plate, and with the slide-rest at the same setting as before; enlarge the hole in the mahogany to a hollow cone. The smaller end, which is outwards, must admit the screwed end of the boxwood. Then, with a parting tool applied to the face of the work, cut out a disc of rather larger diameter than the finished pulley is to be. Mount the boxwood truly on a new mandrel and place upon it the pulley, washer and nut. Turn the pulley to gauge and cut a V upon it to correspond with that upon the metal pulley.

Remove the leading screw and place the wooden pulley upon it to the left of the slide-rest. The pulley can then be fixed in any required position by turning the nut, which pushes the pulley farther on to the boxwood cone and causes this to grasp the leading screw. It can be loosed by unscrewing the nut a little and supporting the whole with one hand while the other presses firmly on the pulley, which will slip back with a click. When not in use, it will be out of the way at the left-hand end of the leading screw.

About 30 ins. of gut band $\frac{1}{2}$ -in. in diameter, and a pair of hooks and eyes to fit will be wanted. In choosing the latter, see that their ends are not expanded, as is frequently the case, or they may not pass freely through the guide-pulleys. With a small file make the ends of the gut slightly conical; put a little tallow in the screw of the hook and eye, and heat until the tallow melts, and then screw on to the gut. Fitted in this way they will never pull off. The exact length of gut needed must be found by trial, Fig. 1 showing the proper position of parts.

A small wire hook for attaching the brass chain must be fastened to a convenient place on the right side of the apron of the slide-rest. The bearing of the spindle of the quick-return motion will, probably, be found most suitable, and the hook can be fastened to it by wire. The appliance is then finished.

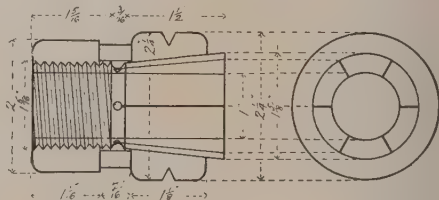


FIG. 5.

Since the pulleys on the leading screw and slide-rest screw are of the same size, they will revolve at the same speed, and, knowing the pitches of the two screws, the feed is easily calculated. In my case the leading screw has four and the slide-rest screw eight threads per inch, so that a combination of change wheels which would give a sliding feed of 1-50th in. gives a surfacing feed of 1-100th in. Hence, it is easy to cut scrolls of any desired pitch. If the slide-rest screw is left-handed, as is commonly the case, the leading screw must revolve as in cutting right-handed threads.

When surfacing, the clasp nut of the leading screw must, of course, be out of gear, and, if heavy cuts are being taken, the slide-rest will need fixing by bringing up the back poppet.

When not in use remove the pulley and the movable arm, and slide the leading screw pulley under the mandrel, and what is left will not be in the way.

OUR new book on "Electric Bells" is now ready. It contains 77 pages and 50 illustrations, many of the latter being from specially prepared drawings. The price is 6d., or post free 7d.

The A.B.C. of Dynamo Design.

By ALFRED H. AVERY, A.Inst.E.E.

(Continued from page 203.)

HAVING dealt with the purely mechanical details of armature construction, of which further examples and working drawings will be given in subsequent chapters, we have now to treat the subject in its electrical aspect. To the uninitiated there is a considerable amount of mystery inseparable from armatures and their windings; but there is not the slightest reason why this should be so, if the subject is attacked in the proper manner.

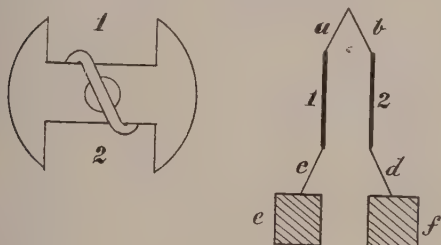


FIG. 34.

It will help very much to elucidate matters if the student will acquire the habit of working out his winding diagrams on the "developed" system. Imagine the wound armature slit radially and opened out flat, so that the whole of the surface and end winding is visible; and when this idea is fully grasped, it will be at once appreciated how useful it is as reference, on account of the ease with which the connections can be traced. To avoid complicating such a diagram with unnecessary lines, one conductor only is drawn to represent each section on the armature, whether it actually consists of one conductor only, or many conductors in series, as would generally be the case; for all that is needed is to show the starting and finishing ends of their connections.

For instance, we will take a very simple example, which will serve as a key to the whole system. Everyone knows how to wind a Siemens' or "H" armature (Fig. 15). It is merely a single coil of wire wound over the thin web of the core-discs, and one end of each connected to one segment of a two-part commutator. Bearing in mind that there are two sections in a Siemens' armature, each of which will be represented by one line only in our developed diagram of the winding (no matter how many turns of wire or conductors there may be on the whole armature), we shall now be able to represent the Siemens' winding diagrammatically, as in Fig. 34; the end view of the armature being shown on the left-hand side.

Numbering the armature sections 1 and 2, we make these correspond with the thick lines 1, 2, in the diagram; and this represents the *active* conductors, while the thin connecting lines *a*, *b*, *c*, *d*, represent the end connections or *inactive* conductors. The square plates *e*, *f*, are the two commutator segments.

It will be remembered that in the last chapter armatures were broadly classified into "open circuit" and "closed-circuit" types. The Siemens armature just described is about the only example of the former variety ever met with in the ordinary way. One does come across an open-circuit tripolar and quadripolar armature

occasionally, but either of the above forms are not to be tolerated in any machine of pretensions to practical or modern design. However, they are illustrated for the sake of completeness in Figs. 35 and 36.

The closed coil armatures, on the other hand, are numerous, and include the tripolar winding (Fig. 37); the quadripolar four-pole, or "Walker" winding (Fig. 38), both of which should be carefully compared to their corresponding types wound in open circuit. There is also a third way of winding a quadripolar armature, by making each slot take two sections of conductors (Fig. 39), but it requires that the teeth in the core discs should not be cut very deep. Fig. 40 gives the connections of a six-part ring armature, which, it will be noticed, is a very simple winding indeed. With all armatures there are two ways of winding, either right-handed or left-handed, and it will depend on this, and on the method of connecting-up, which way current will circulate, and, consequently, whether the armature will run in the one direction or the other. In the ring armature, also, there are two methods of laying on the wire: One is to wind the whole of the wire on each section from a "bobbin" in the usual way, which means bringing the starting end out from the bottom layer to the surface, giving it several chances to leak or short-circuit successive layers in passing, besides upsetting the symmetry of the winding. The other way is to wind off a sufficient length of wire equally on two bobbins instead of one, and starting with one first wind to the middle of the section and back, then do the same with the other bobbin, until the section is full. This brings the starting and finishing ends both on the outside layer, which is a very desirable consummation in the event of any accidental breakage of the connections.

Returning now to our winding diagrams, we have left for consideration the various kinds of drum and tunnel armatures. They need not be taken separately, as the windings are identical in all but the disposition of the wire, which is laid on the surface, or in slots in the case

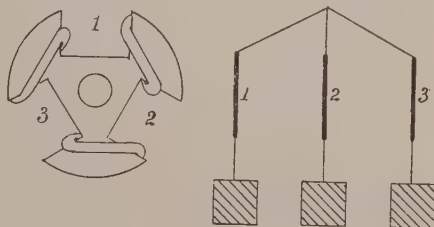


FIG. 35.

of drum armatures, and embedded in or threaded through holes in the case of tunnel armatures. The same remark would also apply to the winding of ring armatures, since the winding diagram will be the same whether smooth or toothed cores are utilised.

There is an almost endless variety of drum windings, and we must confine ourselves here to treating with those intended for bipolar fields only, such as the average reader is likely to encounter in his investigations. In Fig. 17 a perspective sketch of a simple 8 section smooth core drum armature was given; this corresponds to the winding diagram (Fig. 39), and the two should be carefully compared. Fig. 41 will show a 24 section drum of similar design, and which is a type of winding in common use. It is fairly symmetrical, but not well-balanced electrically. The Siemens drum-winding is almost obsolete, and is probably the most unsuitable type it is possible to pitch upon in the light of our latter-day knowledge, since

it is neither mechanically nor electrically symmetrical, and it is hardly worth while to occupy the reader's attention with a diagram. Nor is it advisable to take up space in illustrating the Eickemeyer system of winding, for, although practically the only perfect type of wire-winding in existence, it is far beyond the skill of the ordinary artisan, as it needs very special tools and formers to shape the coils.

A type of winding devised by the author, and found to give most satisfactory results, will be represented in Fig. 42.

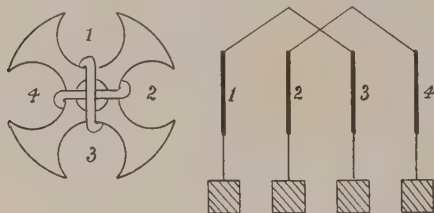


FIG. 36.

The peculiarity of this winding lies chiefly in the fact that the sections overlap one another on the periphery of the core, which offers several mechanical advantages, as will be seen later on. This winding is, as nearly as possible, symmetrical. (Figs. 41 and 42 will appear in next article.)

It remains now but to decide on the respective merits of these various forms of armatures and windings in order that we may select a type that is most likely to conform to the general requirements of all round efficiency and ease of construction. And we may at once begin by discarding the Siemens, the tripolar, and the quadripolar types, as they are unsuitable in any well-designed dynamo. This wholesale condemnation of several much-used types will doubtless be rather a revelation to a good many amateurs; but it is, nevertheless, a fact that their mere presence at once stamps the dynamo as a badly designed and inefficient machine. As pointed out on page 84, more particularly with regard to the Siemens armature, the current fluctuates to such an extent in armatures having but few sections, that great waste arises through self-inductive effects, manifested by destructive sparking at the commutator, which it is

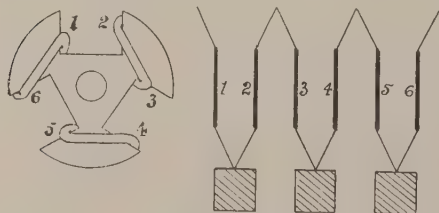


FIG. 37.

impossible to cure by any alteration of lead to the brushes. Besides this drawback, a little reflection will show how very badly disposed are the conductors on such armatures. To get the greatest possible amount of induced E.M.F. in any particular section, it stands to reason that conductors wound in opposite directions should be diametrically opposite one another on the armature core (with bipolar fields), as Fig. 34, for instance.

A glance at the diagrams of the tripolar or quadripolar

windings (Figs. 37 and 38) will show just how far those types comply with these conditions. In their most favourable position, the conductors not only embrace an angle of 120 degs. or 90 degs. respectively, instead of the theoretically requisite 180 degs.; but actually, in the case of the lowest layers sunk at the bottom of the slots, the conductors are, to all intents and purposes, doubled back upon themselves, and, consequently, the induced E.M.F.'s in those turns of wire exactly balance and oppose one another, and this means that all the conductors in that region must be regarded as practically idle wire. Of course, these objections do not so much apply to the drum type of winding occasionally used with a quadripolar core-disc (as Fig. 39), but the other drawback is still in evidence—viz., the impossibility of getting sparkless commutation, owing to the few sections.

Dismissing these types, then, once for all, we will endeavour to fix upon the respective efficiencies of ring, drum, and tunnel armatures.

A great many people seem to be under the impression that drum armatures are only to be entertained when the length of the core much exceeds its diameter. The idea apparently is that the end wire would otherwise bear too great a proportion to the active conductors. It is true that the tendency is towards gain in efficiency with every increase in the length; but when we come to analyse the matter, and see what are the relative amounts of idle wire in ring and drum or tunnel armatures, some of us will

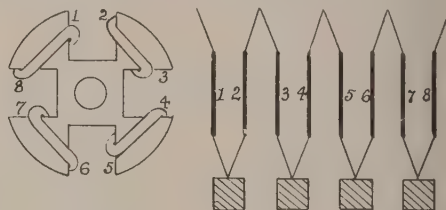


FIG. 38.

learn for the first time that the drum may be cut down comparatively much shorter than is usually thought correct, before the balance turns in favour of the ring. The fact must not be lost sight of that it is only the end wire in the drum or tunnel that is inactive, while in the ring all the end winding, as well as the internal connections, must be deemed idle wire.

Apropos of this, Gisbert Kapp leaves some valuable statistics as the result of his investigations, which will be found embodied in the following table:

Length of armature core divided by its diameter.	Comparative efficiency of ring windings R, and drum windings D.	
	R.	D.
·5	·278	·238
1·0	·356	·385
1·5	·395	·484
2·0	·416	·555

There is thus absolutely no room left for doubt as to which type of armature it is more profitable to employ on the face of this evidence, together with the fact of the great advantage possessed by the drum over the ring as regards simplicity of construction. Probably the true reason why it is not more popular is that most amateurs

take fright beforehand at the complicated appearance of the windings. But the complication is much more apparent than real, and there will be no excuse for avoiding the drum winding after a careful perusal of the various diagrams accompanying this chapter.

The great drawback attending the use of the tunnel armature is the difficulty of winding, as the conductors have to be threaded through holes, a process which is apt, in unskilled hands, to damage the insulation of the wire, and requires much time and care.

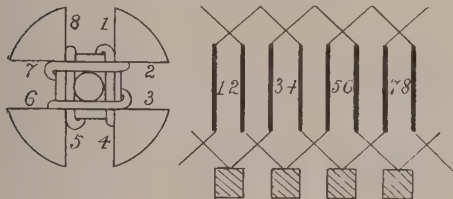


FIG. 39.

Tunnel armatures are, therefore, out of the running, and we have now only to decide whether plain or toothed cores shall be adopted in our drums. The object of providing teeth to the core-discs is to lessen the magnetic "reluctance" of the space between the core and the pole pieces, which it does most effectually. Unfortunately, it increases the cost of the core-discs very considerably, makes proper insulation of the conductors more difficult and expensive, and also is apt to cause heating and sparking troubles.

Wherefore, having regard to all-round efficiency it is the writer's experience that plain cores are decidedly preferable in all machines where the air-gap can be kept proportionately small. It is this very question of air

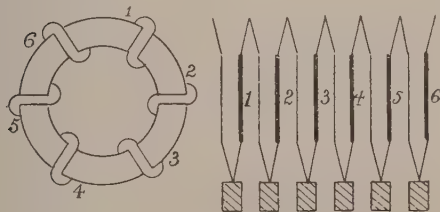


FIG. 40.

space between armature and fields which makes it impossible to design a very small dynamo which shall be the exact counterpart of a much larger one, for we cannot decrease the air gap in proportion to the rest of the dimensions, owing to the constant and disproportionate thickness of insulation on the conductors and the requisite clearance for safe running, both of which remain practically the same throughout the whole range of sizes.

A line of demarcation may be fixed arbitrarily at somewhere about $3\frac{1}{2}$ ins. diameter of core, and it will generally be found advisable to build all armatures under that size with toothed cores, and anything larger in diameter as plain drums.

(To be continued.)

Britain's Latest Battleship, H.M.S. "London."

(Specially written for THE MODEL ENGINEER by a Member of the Portsmouth Dockyard Constructional Staff.)

AT mid-day, on September 21st, H.M.S. *London* was launched from the building slip of Portsmouth Dockyard. The first keel plate was laid down on December 8th, 1898, and at the time of launching weighed 5000 tons.

The *London* is a first-class battleship, and her principal dimensions are as follows:

Length (between perpendiculars), 400 ft.

Length (over all), about 430 ft.

Breadth (extreme), 75 ft.

Displacement, 15,000 tons.

Mean load draught, 26 ft. 9 ins.

She will be propelled by twin screws, each actuated by a set of triple expansion engines of 7,500 indicated horsepower. The steam will be supplied by twenty independent water-tube boilers of the Belleville type, fitted with all the latest improvements, and capable of supplying steam at 300 lb. pressure, reduced to 250 lb. at the engines. The engines and boilers are being built by Messrs. Earle's Shipbuilding and Engineering Company, Limited, of Hull. Her coal-carrying capacity is 900 tons when floating at load draught, but provision is made for the storage of 2,100 tons.

The armament consists of four 12-in. B.L. wire guns of improved type, two mounted forward, and two aft. They are protected by an armour shield 8 ins. thick, and the hydraulic mechanism by a circular redoubt faced with 12-in. armour. Twelve 6-in. quick firing guns of a new type, eight being mounted in casemates on the main deck, and four similarly mounted on the upper deck. The casemate fronts are of 6-in. Harveyised steel. Sixteen 12-pounder quick firing guns, eight being fitted on the main, and eight on the upper deck. Two 12-pounder 8 cwt. quick-firing guns, for field and boat service, also have fighting positions on the shelter-deck forward. In each fighting top three 3-pounder quick-firing guns are mounted for protection against torpedo attack. Along the topsides, eight Maxim guns will be mounted in fighting positions. Four submerged torpedo tubes 18 ins. in diameter, two forward and two aft, complete the armament.

The side armour is 9 ins. thick, and extends 15 ft. below the main deck. It is continued with a gradual reduction in thickness right forward, to meet the special plating on the bow. An athwartship armour bulkhead is fitted at the after end of the side armour, and varies in thickness from 9 ins. to 12 ins.

Three independent sets of dynamos and engines will light the ship, work the electric motor fans and search lights. Every compartment except the double bottoms will be efficiently lighted by incandescent lamps.

Ventilation is secured by the use of electric motor fans outside the engine and boiler room spaces, and by steam fans in those rooms. There will also be a complete installation of electric bells and voice pipes, and in addition loud speaking telephones between important places.

The *London* is an improved *Majestic*, and is about 100 tons heavier. The christening ceremony was performed by Lady George Hamilton. The launch was a thorough success, every arrangement being carried out without a hitch.

READERS who visit the Science Department of the South Kensington Museum, will now find there an interesting batch of loco. photographs by Mr. A. M. H. Solomon.

Brazing.

Some Practical Hints for the Amateur Coppersmith.

By NORMAN R. ENSOR.

I AM tempted to write an article on the above subject chiefly because brazing is an art that should be acquired by all model makers, for those of us who have not been initiated into it, know to our cost how annoying it has been to be compelled to set our model aside for many hours simply because we have not been able to do a piece of work, which perhaps need only have taken us but a few minutes. Though I have termed brazing an art, it is like everything else in mechanical work—"simple enough when we know how." In a large engineering works nothing fascinates the visitor more than the blacksmith's shop, with the glow of the huge pieces of iron at white heat, the thousands of flying sparks and the thud, thud of the ponderous steam-hammer. It is truly picturesque to the novice, and though the blacksmith's shop claims first attention, I must claim second place for the coppersmith's department. Here we find a great deal to interest us, and the knowledge gained in a day spent in a first-class shop will amply repay any of my readers for the time expended.

In our own little workshop we shall require no "rosin-pit," no elaborate pipe-bending devices and brazing forges, no spinning machines and a hundred different kinds of planishing irons and hammers. A few shillings invested judiciously will purchase all we require, and the hammers necessary for working up copper plate will be found among the ordinary list of the amateur mechanic. I shall proceed to enumerate a few of the articles that are indispensable. First of all, and perhaps the most important, is the forge. If preference is given to the old-fashioned type, there is not much choice, but for brazing, the fire hole must not be more than 4 or 5 ins. square, so that the heat may be concentrated in one place. Also, the blast should be continuous and not "jerky." In heavy work, where a considerable amount of iron or brass is to be heated, a coke fire with strong blast is almost essential, but for light work I should recommend a modern brazing forge. Those for gas are the best, and the jet should be so adjusted that it may be used either vertically or horizontally. For those who for various reasons are not able to command a supply of gas, there are some excellent petroleum lamps on the market which are effective enough for small work. The petroleum is vapourised by passing through a coil near the burner in the manner of some of the old alcohol blow-pipes, and by means of the small air-pump attached a good heat is obtained.

Spelter, or hard solder, may be purchased at any hardware store at about 1s. 6d. a pound, according to quality. Borax is used as a flux and should be bought in the lump, and should have a "glassy," not a "chalky" appearance. In preparing the spelter for use, take two or three ounces and wash thoroughly, leaving sufficient water to cover it. After pulverising the borax, add about half a teaspoonful to the spelter and stir well together. Take a piece of $\frac{1}{8}$ -in. copper wire, and beat out one end into the shape of a small spoon. This should always be used to place the spelter on the work. The fingers, which are apt to be oily, should not be used, as grease is the greatest deterrent to good brazing. I may also remark that the rays of the sun should not be allowed to fall across the fire, nor should a cold draught play upon the work.

Now that we have almost all our requirements, let us

try one or two experiments. For example, in marking out a boiler from the sheet, a hole has been accidentally drilled some distance from where it was required, and instead of discarding the copper and cutting another plate, it is desired to "piece" it and drill again. From the side of the plate that will eventually be the inside of the boiler, countersink with a drill; or, if the hole is too large, use a half-round smooth file until the hole is tapered to the other side. From a piece of scrap copper cut a circle and carefully file up until it fits and is flush with the plate; it is better, however, to project through slightly, rather than a hollow be left. To braze up, first clean both pieces by either dipping in nitric acid or rubbing with emery cloth. Lay the piece in its place, take the sheet with a pair of tongs in the left hand, moisten the part to be brazed with the borax water, carefully place the spelter where required, and then pass slowly through the flame until the spelter and borax has dried and hardened. It must not be put into the fire at once, as the sudden heat produces vapour from the moisture and the spelter is thrown off. When it has "baked," as the coppersmith terms it, sprinkle on a little powdered borax, and then allow to heat slowly all over. When thoroughly red, put on the whole blast, and apply more borax. When the spelter begins to flow, shake gently until it runs through to the other side; then take off the fire, scrape off the melted borax, and examine before cooling off. If not entirely satisfactory, repeat, allowing it to remain a little longer on the fire. When cold, round up the plate slightly on the mandrel and file up. The inside, of course, need not be touched, and only a thin line of yellow will be left visible on the outside if a good fit was made in the first place. A brass collar that has to be brazed on to a piece of pipe should be a "snug" fit, and the pipe slightly rivetted over to keep the collar in its place and to prevent the spelter from running through into the fire. Hold the pipe vertically, and proceed as in the previous experiment.

In brazing on a "cone" or "ball" joint, it is, of course, important that they should not be burnt or injured by the fire. To prevent this, the joint should be neatly embedded in a ball of clay, nothing of the brass remaining visible except the actual brazing surface. It is best brazed while held in a horizontal position, as otherwise the joint would fall off when it had expanded with the heat. Place a small quantity of spelter on one side only, and when baked, the pipe may be turned round until the spelter is nearest the fire; apply borax, and as soon as the solder begins to run, turn slowly round until the joint is made. Any surplus solder may be shaken off by raising quickly from the fire.

In a future issue I shall endeavour to show the best and easiest methods of working up a boiler from the plate, dovetailing and brazing together, &c., but if the foregoing and similar experiments are tried, an insight into the art will have been acquired. The first attempt at brazing may, or may not, be a success, but experience and perseverance will overcome all the difficulties that arise at first, and for what little failures are encountered in the beginning, ample is the reward in the consolation of not having to take a piece of work out of the shop, and entrust it to someone else, whether professional or not, who, to say the least, would not treat it with the same care and consideration as the owners.

In concluding, I shall give a few hints which may prove of some service to those who meet with continued misfortune in their attempts to braze. It must be borne in mind that pale brass, that is, a metal containing a superabundance of zinc, will not braze satisfactorily with ordinary spelter. The best brass for brazing is composed of copper (14 parts), zinc (5 parts), and lead (1 part). This will not melt under 1,700 degs. F.,

and as ordinary spelter "runs" at some hundreds less, there is little fear of the brass being injured by the fire before it is thoroughly brazed. If, however, difficulty is found in making the spelter flow freely, take a piece of block tin and rasp or file off a small quantity, and add to the spelter. For any light work the proportions may be equal without any deleterious effect, and brazing will be a pleasure, and the results satisfactory. In using a gas forge the heat may be concentrated in any desired spot, but with a coke forge the greatest heat is naturally underneath, so that an article that may not be moved after being placed on the fire obviously becomes hotter on the one side. In brazing such a piece of work, heat very slowly, until the whole has become red, then use the full blast and "coax" the solder by placing a piece of wood above it; this will retain the heat and drive it back, as it were, on to the article to be brazed. It may be needless to impress upon my readers the fact that clean surfaces are absolutely essential if good work is desired. Considerably more time should be spent in preparing the work for the fire than the actual time of brazing. In model work, and, in fact, in any other mechanical work, hard solder should be used in place of soft where at all possible. It is preferable in many ways, for besides being stronger, it resists heat better, is more workmanlike, and it has a better appearance, which is, I am sure, by no means the least item of importance in a well-constructed model.

For the Book-shelf.

[Any book reviewed under this heading can be obtained from THE MODEL ENGINEER Book Department, 6, Farringdon Avenue, London, E.C., by remitting the published price and cost of postage.]

ARC LAMPS AND HOW TO MAINTAIN THEM. By H. SMITHSON and E. R. SHARPE. London: Whitaker & Co., 2, White Hart Street, Paternoster Square, E.C. Price 1s.

This is a straightforward little work intended for those who use arc lamps or have them under their control. It is simply and clearly written, the types of lamps being explained in a practical way and the method of trimming and cleaning them fully set forth. The instructions for slight repairs within the capacity of the non-technical user are also of a practical nature, and ought to save a good many little annoyances and vexatious expenses.

MAGNETISM AND ELECTRICITY FOR BEGINNERS. By H. E. HADLEY, B.Sc., A.R.C.Sc. London: Macmillan & Co., Limited. Price 2s. 6d.

Some little time ago we had occasion, in reviewing a book on applied mechanics, to note how the growth of the subject had largely modified the method of teaching it. Practically, the same remark applies here, with, perhaps, even greater force. We well remember, and, indeed, still have in our possession, the text-books of electrical science which did duty in our early days. The well-printed, attractive volume before us puts those weather-beaten books away into the limbo of the past altogether, and must prove itself of enormous value in the hands of the modern teacher and student. We may say at once that the author is a firm believer in treating his subject from the experimental point of view, and this, we venture to think, is practically the accepted method with all the best teachers. The student is exhorted to make his own apparatus and do his own experimenting, not merely by description and diagram, but by having presented to him clear photographs of the apparatus as it can actually be rigged up in the simplest possible

manner. About two hundred illustrations are given, and a very large proportion of these are not only quite fresh, but have the merit of being unmistakable in their meaning. There is more than one way of studying the science of electricity, but the best is that by means of which the student is so fascinated by the subject that he would not care to skip even the ordinarily "dry" parts. We feel that Mr. Hadley's book will effect this object; and, as it comes at a time specially suited to the Science and Art and other exams., to which end it is intended, we hope its sale will be a large and extending one.

ELECTRIC WIRING, FITTING, SWITCHES, AND LAMPS. By W. PERREN MAYCOCK, M.I.E.E. London: Whitaker & Co., 2, White Hart Street, Paternoster Square, E.C. Price 6s.

This book is a great deal more interesting than its title would lead the average reader to suppose. It is described as a practical book for electric light engineers, wiring and fitting contractors, consulting engineers, architects, builders, wiremen, and students; but we can confidently predict for it a much larger circle of friends, especially amongst those whose practical minds require something fresher than the text-book "examples." We cannot say that the contents depart very far from what the title sets forth, by which is meant that the subject is treated thoroughly all through. It is nearly all new, quite up-to-date, and the author's apologies for delaying its appearance are handsomely discounted by his efforts to get the very latest information in the pages of his book. As a result it is a work which we can recommend not only to the class of electrical workers already indicated, but to every private and public user of electric energy. It ought to be of special benefit to those who are thinking of having the current "laid on," and to that other large class who have already had it installed and wish to know its full capabilities in private use. The book contains over 350 illustrations, and many useful and well-arranged tables of reference.

HOW TO INVENT MACHINERY. Edited and supplemented by W. H. ATHERTON, B.Sc., from the original by Charles Babbage, M.A. Manchester: The Vulcan Publishing Company, 10, Exchange Arcade. Price 4d. (nett).

The attractiveness of the subject ought to induce a large sale of this little pamphlet. It is, as the Editor remarks, a reprint of some remarks by the late Mr. Babbage, of calculating machine fame, and as such, is surely entitled to be reckoned amongst the "classics in science." However, although the same truths apply today in machine design as they did seventy years ago, they require to be amplified and supplemented, and this part Mr. Atherton has undertaken as his share of the task. We should say that the young draughtsman will do well to study the booklet. A draughtsman spends a very large portion of his time in inventing and devising, although this fact is generally overlooked, and many of the paragraphs in the pamphlet he will find of great practical use.

MR. H. P. MORRIS, whose description of a Fast Model Torpedo Boat Destroyer appeared in our columns in March last, writes us to say he is quite unable to deal with the mass of correspondence he has received on the subject, and requests us to state that he cannot answer any further communications.

ERRATUM.—On page 218, October issue of THE MODEL ENGINEER, second column, eleventh line, for "Fig. 2" read "Fig. 1, E."

Model Railways.

III.—A Miniature L.B. & S.C. Railway.

IN the majority of the model railways which it has so far been our pleasure to inspect, the chief interest has been centred in the locomotives and rolling stock, while the permanent way has been largely, if not entirely, of secondary importance. Indeed, it frequently happens that the actual railway is only called into existence to provide a means for demonstrating the capabilities of one particular model locomotive, and while on the engine the work of months and sometimes years is ungrudgingly bestowed, the permanent way is knocked together in the crudest and least troublesome manner possible. The model line we are about to describe is a decidedly interesting exception to this rule, for although the engines and carriages are not without features of considerable merit, the chief idea in laying down the line was to pro-

vide a system over which a definite and properly arranged service of trains could be worked. It is a correct model in so far as it includes all the principal lines, junctions, signals, points and crossings which exist on the real railway; although on so small a scale it has been impossible to reproduce all the stations, bridges, etc., and to give the many minor signals which, though necessary in the real article, would only introduce needless complication when in miniature. A departure from actual scale has also been made in the lateral dimensions of the railway, Victoria Station being located alongside London Bridge, this compression being necessitated partly by the limited space available, and partly by considerations of convenience in manipulating the rolling-stock.

Those of our readers who are regular travellers on the Brighton railway will readily recognise the principal features of the permanent way, shown in the accompanying diagram and photographs; but a somewhat detailed description of the various roads and crossings will



THE FOREST HILL TO CROYDON PORTION OF THE RAILWAY.

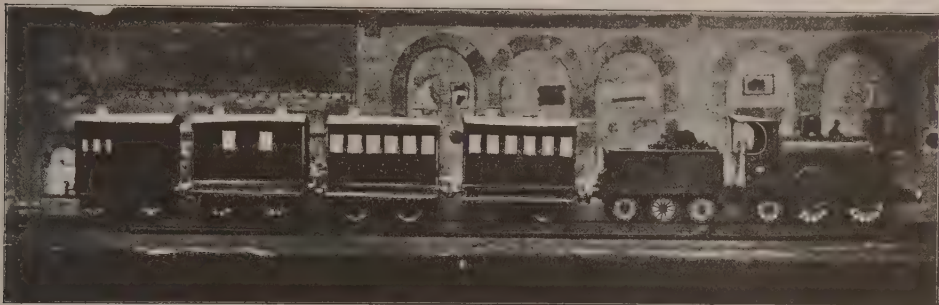
vide a system over which a definite and properly arranged service of trains could be worked.

This railway is located at South Norwood, at the residence of Dr. Gerald Hovenden, who, in conjunction with his brother, Dr. Arthur C. Hovenden, has planned and carried out the entire construction. A third name, and a familiar one to our readers, must, however, be mentioned in this connection—viz., that of Dr. J. Bradbury Winter, of Brighton, the builder of the famous model "Como" locomotive; for Dr. Winter, who takes a keen friendly interest in the working of this line, has recently designed and constructed some most ingenious clockwork engines for operating the trains. He may, perhaps be best described as the consulting locomotive engineer to the railway; but of his work we shall have more to say anon.

The railway is a correct model of the suburban London portion of the London, Brighton and South Coast Railway, and embraces the whole of this railway between the two London termini of London Bridge and Victoria at

probably be of some interest and assistance, even to Brighton-ites.

Before commencing we must explain that ordinary up and down lines are represented by a single line, but where there are main and local lines—as on the London Bridge and Victoria sections—there are two lines. On referring to diagram, and starting from London Bridge, it will be seen that between London Bridge and Bricklayers' Arms Junction there are two lines. These represent on the up journey, up-main (outside), up local (inside); on the down journey there is only one down line, and this is the inside one. At Bricklayers' Arms the single down line branches into main (inside) and local (outside), each of which also receives a branch from the Willow Walk sidings. Between Bricklayers' Arms and Norwood Junction there are two stations—New Cross and Forest Hill—and here there are two lines which, going down, represent down main and local, and, going up, up main and local (the up and down local becoming the down and up main). Between Forest Hill and Nor-



ONE OF THE ORIGINAL PASSENGER TRAINS.

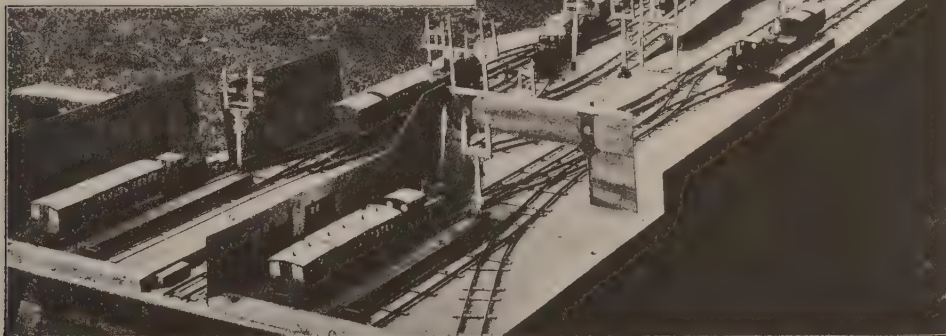
wood there is a junction called Norwood Junction North, where provision has to be made for down trains to travel main to local and local to main, and for the Crystal Palace line from Victoria to pass to both local and main. The points also allow of up trains crossing over from main and local, and to the Palace in a similar manner. The Crystal Palace and the main and local lines have also a branch into the Norwood Junction Sidings. After Norwood comes Windmill Bridge Junction, where the relationship of the lines to one another is very much altered. The main line crosses the local line and divides into two (the two outside lines), both of which run to East Croydon; of these, the outside one is a down relief line, and the inside one is up and down main. The up and down local are represented by one line, and this shortly splits up into New and West Croydon lines. The line from Victoria through Selhurst also has to have points to go to West and New Croydons, and to the main line at East Croydon.

Now let us trace the other portion of the line, starting from the Victoria Terminus. We at once find something of special interest in the arrangement of the lines, for the model actually anticipates the alterations which the Brighton company are shortly to put into practice. Of the two lines here, the outside one is the up main, and the only out road; while the inside line is the up local. Travelling south we reach Poupart's Junction, where the down line divides into main (outside) and local (inside); these coming up are up-main and local in the same position. After passing through Clapham

Junction, Balham is reached, and here the branch from the local line is given off to the Crystal Palace, which joins the London Bridge line at Norwood Junction. At Balham, too, another change occurs—the main and local lines being now represented by one up and down line for all trains. This passes through Thornton Heath and Selhurst to join the London Bridge line at Windmill Bridge Junction.

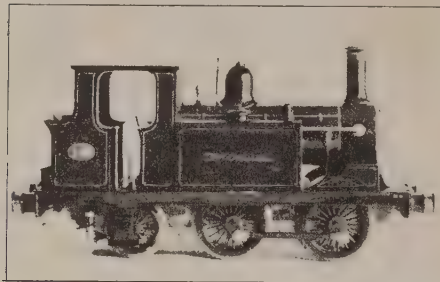
Returning to the London end of the model track, we find a siding between the London Bridge and Victoria stations. This corresponds, in the working of the line, with Battersea goods yard when trains come from Clapham Junction, and Willow Walk when trains come from New Cross. There is also a third line running between London Bridge and Sutton *via* Tulse Hull and Mitcham, which crosses the Crystal Palace and the Thornton Heath lines by bridges at a higher level.

The model line is mounted on a large, built up wooden



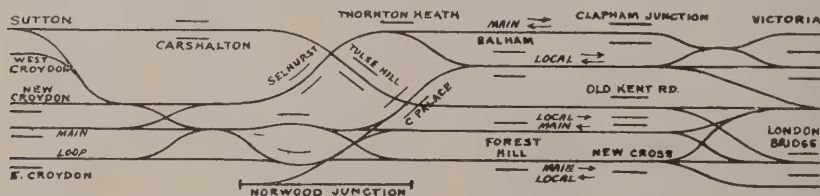
THE LONDON BRIDGE AND VICTORIA STATIONS.

base-board, the total length being about 22 ft. The width varies from 2 ft. 4 ins. to 2 ft. 8 ins. Altogether there are five distinct roads; and with crossings, &c., the total length of track amounts to about 120 ft. The gauge is $1\frac{1}{4}$ ins., which is approximately a scale of $\frac{1}{4}$ in. to the foot; while the six-foot way between rails measures $1\frac{1}{2}$ ins. It takes about twenty seconds for a train to complete its journey. As the distance on the real line is nine miles, and the usual time for the journey is twenty minutes, it will be seen that the model trains perform their journeys very closely to "scale-time," if we



CLOCKWORK LOCOMOTIVE FOR LOCAL TRAIN.

can so term it. A standard curve of 3 ft. radius has been adopted for all curves and crossings on the model line. The rails are made up of lengths of strip brass $\frac{1}{4}$ in. by 1-16 in., soldered on edge to flat brass sleepers $\frac{3}{8}$ in. by 1-16 in. The rails are, as far as possible, in six-foot lengths, with the sleepers placed at intervals of 3 ins., but with so many points and crossings too occurring, it has been found necessary to lay down much shorter lengths than the above throughout the greater portion of the track. The signals are constructed of wood and cardboard, and, except that the arms move up and down when touched, they are at present only dummies. A scheme is at present under consideration, however, whereby the automatic



PLAN OF THE RAILWAY, SHOWING JUNCTIONS AND CROSSINGS.

operating and interlocking signals and points can be carried out, and thus always ensure a clear road. The stations at London Bridge and Victoria have received some little attention from the decorative department, and are adorned with miniature reproductions of many well-known advertisements; but at the time of writing the intermediate stations are represented only by bare platforms.

The manner of running this model line is as follows: A definite time-table of about twenty trains is arranged, and these are dispatched from the different termini according to the order. By running two or three trains at the time, and causing them to pass or cross one another at the different junctions and bridges, some exceedingly pretty combinations are obtained.

(To be continued.)

The Wehnelt Electrolytic Interruptor for x-Ray Work.*

By H. W. COX.

SINCE the discovery made by Dr. Wehnelt of applying the electrolytic interruptor to induction coils, I have made a number of experiments with the view of applying it to x-Ray work without injury to the tubes. I believe it is generally supposed that only the tubes of a very high vacuum could be used with any degree of safety; but I find that tubes of a moderately low vacuum have given me best results, and are by far the best to use; they do not give quite such a brilliant production of x-Rays as tubes of a higher resistance, but, on the other hand, they give excellent results, will stand a much longer run, and the platinum anti-cathode is not so liable to get fused or pierced. With the high resistance tube a greater E.M.F. is required to overcome that resistance. Consequently, there is also an increase in the amperage or the richness of the spark to such an extent that the anti-cathode almost instantly becomes incandescent, and unless the current is switched off at once, the platinum will fuse and the tube be destroyed. With a moderately low resistance tube less E.M.F. is required to overcome the resistance, and the current passing through the tube is proportionately less, the result being that the anti-cathode does not become so hot; and I have worked them from ten to twenty minutes continuously, giving excellent results. Another advantage is, that should the anti-cathode show signs of becoming too hot, the current can be turned off and another tube put in its place, or the tube can be left to cool, when the current can be switched on again.

I also find that tubes with large bulbs run longer than those with small bulbs; this, no doubt, is due to the larger surface for radiation, which helps to keep the tube cool. The massive electrodes devised by Mr. Campbell Swinton is also an advantage in preventing the fusing of the anti-cathode; with a 50-volt accumulator and the Wehnelt interruptor, little or no resistance need be inserted in the circuit providing the tube is a suitable one, but with a 100-volt circuit a variable resistance is necessary. When working with two interruptors connected in

series off a 100-volt circuit, I found the tubes run more evenly than when working with one. But with one interruptor and an inductance in the circuit, also the resistance, the tubes run much steadier, and the interruptor does not so frequently stop even when the electrolyte becomes hot, and the frequency of the break seems to be increased. This, I believe, has also been discovered by Mr. E. W. Caldwell, of New York, though I had not read it till after I had tried it.

The coil I used was a 10-in. spark one, and when working with one electrolytic interruptor and a resistance off a 100-volt circuit, the current passing through the coil was from 7 to 8 amperes, and when the interruptor stopped

* Paper read before the Röntgen Society.

of itself only about one ampère passed through the coil; with two interruptors on the same circuit connected in series, the coil took about 5 amperes; and when they stopped working only about '5 of an ampère passed through the coil, so there is no danger of burning up the coil owing to the stopping of the interruptor. The interruptor never stopped, but had it done so the amount of current would have been the same.

With an inductance in the circuit and the same resistance, the current passing through the coil was about five amperes. The liquid interruptor never stopped working, but if it had, only about one ampère would have been going through the coil.

I find that if the active electrode of the liquid interruptor is an inch or an inch and a-half away from the cathode, it works better than when quite close to it. I have tried an interruptor with the electrolyte flowing through a tube out of which a small platinum wire projected at the end, the electrolyte was forced against the cathode, the results obtained were not very satisfactory, but owing to my time being somewhat limited I have not been able to finish my experiments. With the alternating current I have not been able to get very satisfactory results.

In constructing the interruptor it is important that the cover should stand well off the containing vessel in order that the gas given off may escape.

Melting Metals in the Amateur's Workshop.

By "F.E."

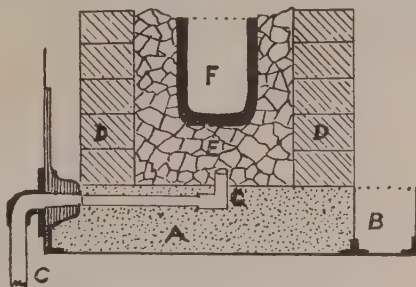
MANY amateurs have not a brass furnace or other properly constructed fireplace in which they can melt brass, aluminium, zinc, and other fairly easily melted metals, and although they have a proper portable forge, the idea never strikes them that this can be "rigged up" to make a very good melting furnace on which anything, even iron, can be very easily melted up to quantities of from 7 lbs. to 9 lbs. weight. For the assistance of those who wish to try their hands at metal-casting, I show an arrangement which I find answers well in practice, and which would suit all amateurs—and a good many trade workers as well—who require castings of a few pounds in weight; and, premising they have skill enough to make the moulds, they may very well do their own work in this direction.

Having the forge, it will be necessary to see that the hearth is level full of ashes, and on a level with the hole in the tue-iron to bed in a piece of 1-in. gas-barrel, having an angle at the end as shown in the sketch. This should be made air-tight at the junction with the tue-iron with a piece of well-tempered clay or putty, and then a temporary firebrick stove should be made by building up the bricks as shown. No mortar or fireclay is needed if the bricks are arranged closely together, and unless several days' melting has to be done; but, of course, a lot of work would pay for the use of a little fireclay.

The fire is lighted with a few shavings and sticks, and a handful of coal broken to the size of filberts, and when these are lighted, some coke broken to about the size of pigeons' eggs is added, and when glowing the furnace is about half filled with broken coke. On this the crucible containing the metal is placed, and broken coke well packed round it, and a gentle blast put on to render the coke incandescent. After the first melting, when crucible and everything is hot, 9 lbs. of zinc, tin, or white metal can be melted in about fifteen minutes, and the same

weight of copper, brass, or aluminium in thirty minutes, while iron would take just over an hour, unless it be in one large piece, when a longer time will be necessary.

Good hard furnace coke is necessary to stand the blast when copper or iron is being melted, but hard gas coke can be used for brass and the like, which melts at a lower temperature. The hard coke can usually be had at the nearest iron foundry, and the gas coke through the usual channels.



SMALL FURNACE FOR MELTING METALS ON A PORTABLE FORGE.

I prefer the Morgan Crucible Company's crucibles, the small sizes at 9d. and 1s. 6d. each being the most useful for amateur work, as these take either 3 lbs. or 9 lbs. of brass. Each crucible should stand from twenty-five to thirty heats with careful handling, and here and there some will stand more.

To handle and pour the crucibles tongs are wanted, and for present use I find a pair of coke tongs about 3 ft. long, and with the jaws bowed, so that they grip the sized crucible in use, to be as handy as any, and the nearest blacksmith will turn these out very cheaply.

The sketch given shows a section of a portable forge with the furnace, crucible, &c., *in situ*, A being the hearth; B, trough; C, pipe to the iron; D, firebricks; E, coke; F, crucible; and G, piece of gas barrel, with elbow. Beyond this the sketch explains itself.

THE September and October issues of THE MODEL ENGINEER are now out of print, but all other back numbers for 1899 from January to August can still be had at the usual price of 2d. each, post free 3d. Readers who require these should order at once.

THE cleaning of the brushes and vessels in which the varnish or oil paint has dried is usually done by boiling with soda solution. This frequently spoils the brushes or cracks the vessels, if of glass; besides, the process is rather slow and dirty. A much more suitable remedy, according to the *Farben Zeitung*, is amyl acetate, which is a liquid with a pleasant odour of fruit drops, used mainly for dissolving and cementing celluloid. If amyl acetate is poured over a resinified oil paint brush the varnish dissolves almost immediately, and, though ever so hard and dry, the brush is again rendered serviceable at once. If necessary, the process is repeated. For cleaning vessels, shake the liquid about in them, which softens the paint so that it can be readily removed with paper. In this manner much labour can be saved. One kilo of pure amyl acetate costs two marks (about 2s.), hence the method is cheap as well. The amyl acetate can be easily removed from the brushes, &c., by alcohol, oil of turpentine or varnish.

Model Yachting Notes.

[The Editor will be glad if the Secretaries of Model Yacht Clubs will keep him advised of all doings of interest suitable for insertion in this column.]

AT the time of going to Press with this issue the much-talked-of contest for the America Cup has only resulted in seven "off" days, no completed race having yet been sailed. It is probable, however, that before these lines meet the eyes of our readers, the whole series of races will have been sailed and the cup won—or lost. The general public have pretty freely expressed their disgust and disappointment at the lack of a fair sailing wind which has so far prevented the races from taking place, but model yachtsmen know the fickleness of a breeze only too well, and many a model race has had to be postponed for the same reason as have been the early attempts of the *Columbia* and *Shamrock* to fight their friendly battle.

It may be of interest to some of our readers to learn of the enterprise of one of the London evening papers, the *Evening News*, in reporting the progress of the racing in quite a novel way. The plan adopted was simple but thoroughly effective. On the scaffolding outside the National Telephone Company's new premises, facing the Embankment, at the bottom of Temple Avenue, an immense canvas, specially painted by Mr. Banks, was erected, showing the course over which the race was sailed. The canvas was lighted by electricity, and was connected by an electric cable with the New York cable receiving-room in the *Daily Mail* building adjoining. By arrangements with the special correspondents of the *Evening News* in New York, messages giving the progress of the race were received every ten minutes, and as they came to hand models of the yachts were moved through slits cut in the canvas, the position of the vessels during the contest being thus shown. Each model boat was illuminated by forty diminutive electric lights, those on the *Columbia* being coloured red and those on the *Shamrock* green. The spectators heartily cheered either boat as it obtained an advantage over its rival, and in this respect they may be said to have been quite impartial; but some not unnatural bias was nevertheless displayed in favour of the *Shamrock*, "Rule, Britannia" being cordially sung whenever Sir Thomas Lipton's yacht was leading.

By the way, readers who want to post themselves up in the history of the America Cup races, should get a book entitled "The Story of the America Cup," published at the offices of the *Glasgow Citizen*, St. Vincent Place, Glasgow. This contains seventeen pages of most interesting matter, and a large number of capital drawings illustrating, including a number of pictures of the boats which have previously raced for the cup, and sketches showing the outlines of their hulls. The cost is one penny only. We are indebted to Mr. G. R. Scott, of Ayr, for calling our attention to this excellent little publication.

We are asked to state that the hon. secretary of the Wirral Model Yacht Club is Mr. J. M. H. Taylor, 13, Ravenscroft Road, Birkenhead, and not Mr. E. W. Wynne, as stated in our July issue.

The Secretary of the Guernsey Model Yacht Club kindly sends us the following notes on their recent races with the boats of the H.M.S. *Curaçoa* M.Y.C.:—"The *Curaçoa* Club has eight to ten fine models, which have won many prizes in British waters, one of which won the West of England Challenge Trophy last year. They,

however, are open-sea sailers, and have never sailed on a pond before, consequently they won nothing in the two races first decided. Another disadvantage to the visitors is that their measurement is the R.Y.A. sail area. The G.M.Y.C. is different, and they find it very strange to sail against boats heavily canvassed. Owing to lack of wind it was found impossible to complete the programme. The naval visitors also sailed for a silver cup, presented by Mr. F. Dicker, and a piece of silver plate for naval men alone, presented by Messrs. Lipton, Limited."

We would direct the special attention of our Liverpool, Manchester and Leeds yachting readers to the letter from the Newsham Park M.Y.C., which appears in this issue. The organising of an inter-club race should not be found a very difficult task, and we are sure it would do much to rouse local interest in the pastime of model yachting, to the benefit of all the clubs concerned; who will take up the challenge laid down by the Newsham Park Club?

Correspondence.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication. Communications should be written on one side of the paper only.]

Model Yacht Measurement.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I am glad to see that Mr. T. A. Bruce has given us his help in this question, but must challenge the average dimensions he gives for 10-tonners. Going through the numbers of the old *Model Yachtsman and Canoeist* for 1892, I have extracted all the different measurements of these craft there given, and find that the average works out at 40 ins. by 8 ins., and not 42½ ins. by 7½ ins., as he states. The draught, where mentioned, in no case exceeded 9 ins., and not 13 ins., as Mr. Bruce gives it. Such models would, therefore, work out at 18½ tons under Roath Park Rule. As compared with a moderate 10-rater, 40 ins. by 10 ins. by 10 ins., or 20 tons, under the same rule, I think the 10-tonner receiving 1 minute start in 40 minutes would make a very creditable show, and better still if the 10-rater were 21 tons (the average size of these models according to Mr. Bruce), as a further 40 seconds would be conceded to the 10-tonner.

It is hardly worth while, however, to discuss the question from this point of view. Those who have not seen a miscellaneous assembly of models sailing under the rule can hardly form an idea of its operation, and might accept the assurance of those who have, that the rule is—though not, of course, perfect—at any rate one that gives good sport and enables a comparison of the different types to be made—a thing which is most desirable from every point of view, and which very few rules succeed in doing. Mr. Bruce's long experience will tell him that a direct tax on the hull of the boat favours body and displacement. The amount of advantage gained by heavy boats will depend on the proportionate tax upon each of the elements of length, beam and draught.

Mr. N. Smith proposes in the same issue of yours as that containing Mr. Bruce's letter a rule which tends in the right direction. It is simple to work out, and has the attraction of giving similar results to the Linear Rating Rule of the Y.R.A. This last feature is what to my mind exposes its fault. The tax on beam and draft is rather too small. Under the Y.R.A. Rule a moderately narrow, roomy boat of some fair displacement will never be built

to succeed in racing. The tax favours the broader boat. Under the old 1730 Rule, reducing it to the same linear form as that adopted by Mr. Smith, only 3-10ths of the water line length was taxed. Mr. Smith proposes to tax 2-3rds of it. The Roath Park Rule, reduced to the linear form, taxes one half of it. It is seen at once that the 1730 Rule could not produce anything but a long boat. Mr. Smith's Rule taxes length a little too much, and I think that the Roath Park Rule taxes it rather too little. I would suggest that in taxing 3-5ths of the water-line we should be about right. Beam and draft are taken in their entirety in each of the Rules. Let us suppose the case of a boat of moderate dimensions all round, say 40 ins. by 10 ins. by 10 ins. Under the 1730 Rule, taxing 3-10ths of the water-line, such a boat works out at 32 tons, or feet, or what you like, taking the draft into account; under Mr. Smith's Rule, taxing 2-3rds L.W.L., 46 and a fraction; under Roath Park Rule, 40; and under the rule I suggest, taking 3-5ths of the water-line, 44.

By having different classes of models, not exceeding a certain rating under such rules as the last three, I think competitors in inter-club races would find that the models for a certain class were of a very similar effective size, and that sport would follow; the classes would be built to and an interesting process of selection would be established by which it could be ascertained which was actually the best all-round proportion of weight, length, beam, draft and sail area for a model, a thing which I suppose is as far from being known to-day as it was a hundred years ago. Mr. Smith uses a strong argument against restriction of sail, and one which will meet with support in nine clubs out of ten. On inland waters sailing is conducted under conditions that do not apply where the models are sailed in salt water. Some few clubs are fortunate enough to have their ponds situated high up on breezy, open commons, and they, of course, find restricted sail area work very well. It is quite a mistake to suppose that a boat with very long overhangs is the best. I do not, therefore, see the desirability of taking any account of over all length. It will only produce saw-offs. Those of your correspondents who will not carry a model anywhere weighing over 20 lbs. to 25 lbs. should not cut up rough because a competitor is willing to carry his 40-lb. boat to the fray. There are lots of reasons why a very heavy boat, for her length, is not a good thing to have, apart from the question of avoidpoups, and even unlimited sail area has not in my experience prevented a very great many of the prizes going to the moderately canvassed boats. The "tendency of every rule is to progress towards a stereotype," but let that stereotype be something better than the L. & S. A. model.—Yours, etc.,

Cardiff.

CHAS. E. HANCOCK.

One Measurement for British Model Yacht Clubs.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—We have just completed a fortnight's cruise in the Channel Islands, visiting Guernsey and Jersey; and our model yachting experience there furnishes another plea for "One Measurement Rule for British Model Yacht Clubs," to make inter club matches possible, without the necessity, as now, of using some time allowance based on various rules, and which has never yet given satisfaction; and, further, of giving a model of moderate proportions and weight, convenient for travelling to other club centres, and for carriage by hand.

We found great enthusiasm existing for the sport; and they gave us a right royal welcome—but, and here comes the objection, one club in Guernsey, two in Jersey, and our club, each had a different measurement rule; bringing out various styles of boat, some ancient and

some modern, and boats from each club could not be sailed against each other fairly.

I understand your paper reaches most model yacht clubs, worthy of the name, and I venture, therefore, to suggest that in two months time, say in time for your January edition, all clubs which are willing to adopt and build to the rule selected by the majority (making separate classes for the old boats) should call a meeting on the subject, thrash out their best idea for a rule, send the particulars to you, stating at the same time that they will accept the rule selected. A report might appear, giving the name of each club and its suggested rule, and then the final decision could be arrived at by a committee of London model yachtsmen, or of such other clubs as could conveniently send a representative.

H.M.S. *Ciraca's* club suggests the following rule:

LWL + Girth, *i.e.*, LWL to LWL

$\times$ Sail area $\div 6000$ = Rating.

Girth to be measured by taking the distance from the LWL on the one side down under the keel and up to the LWL on the other side, and we are willing to adopt the rule decided on by the committee of the, say, M.Y.R.A. (Model Yacht Racing Association).

I trust my suggestions will be charitably received by all true sporting model yachtsmen, and I shall be pleased to hear that the "best rule" has been selected with which to start the year 1900.—Yours faithfully,

H. LYON, Commander, R.N.,

President of H.M.S. *Ciraca's* Model Yacht Club.
Yarmouth, September 18th.

Inter-Club Races.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—The members of the "Newsham Park" Model Yacht Club take this opportunity of fully endorsing your remarks that appeared in the September number, regarding inter club races.

We may say for the past three months we have been using our best efforts to promote these races, and addressed to the various clubs a friendly letter, setting forth the suggestion, and inviting co-operation, but up to the present the matter lies dormant. Now that you have referred to the same, we trust your efforts will be used to the best advantage to secure the result required.

You will be glad to know that our first race of the winter season, held on Saturday, 7th inst., was a complete success, and we intend to continue the same every third Saturday, till April 30th, 1900.

We appreciate your racy little article on our club, in your September number, also, and hope to be able to further your efforts, *re* model yacht racing, in all its branches. Trusting you will be able to find room for this letter, or any part of it that you think fit, in your next issue, I remain, yours faithfully,

C. A. S. BERNASCONI,
Secretary "N.P.M.V.C."

36, Hannan Road, Kensington, Liverpool,
October 9th, 1899.

List of Model Yacht Clubs.

In addition to the list of model yacht clubs published in these columns some time back, the following should be added:

CARDIFF.—W. H. Smith, Hon. Sec., 84, Clare Road, Cardiff.

We invite the attention of our model yachting readers to this list, and hope all those clubs which have not already been mentioned will send their official addresses at once.

The Editor's Page.

THE objection to the amount of the prize in our Model Locomotive Competition, which we discussed in our last issue, is apparently not very generally shared by our readers, as, so far, we have not had a single letter in response to our invitation to intending competitors to ventilate their views on the subject. This seems to indicate one of two things: either that the intending competitors are quite satisfied with the value of the prize offered, or that, for some reason or other, our readers do not intend to enter the competition at all. We hope the latter is not the case, as we certainly think the subject is one which should interest many of our locomotive friends. For the benefit of new readers who are not familiar with the terms of the competition we repeat the details below.

We offer a prize of £1 Is. for the best design for a model loco. to fill the following requirements:—The model to be of main line engine and tender, the engine to be powerful enough to pull a load equal to twice its own weight, on the level; the gauge to be $3\frac{1}{2}$ ins. The greatest width should not exceed 7 ins., and the greatest height should not exceed 10 ins. The fuel may be either coal, charcoal, spirit or oil, at will of competitor, and the working pressure should not exceed 50 lb. per square inch. The boiler must be capable of maintaining steam for at least fifteen minutes without replenishing. The engine is to be fitted either with bogie or radial axles, so as to be capable of running round curves of 5 ft. radius. Provided the foregoing general conditions are complied with, the general design of the engine is left entirely to the competitor's own discretion.

It must be borne in mind that the design should show a model intended for good working qualities, and in making the award preference will be given for the design which, while being neat and well-proportioned in general appearance, shows at the same time the greatest simplicity and workmanlike character in the details of construction. Other points being equal, the prize will be awarded to the sender of the neatest drawings. The drawings should be in good black Indian ink on white cardboard, and no coloured lines or washes should be used. The leading dimensions should be neatly shown in figures, and the scale to which the drawings are made should be stated. The views shown should include a complete side elevation and plan of the engine and tender, and end elevations showing front of the engine and interior of cab respectively. Detailed drawings of boiler, motion-work, lamp, &c., should be shown on a separate sheet if necessary. Each competitor should send a short description of, say, about five hundred words, pointing out the leading features and advantages of his design. Competitions should bear the full name and address of the sender on all the sheets, and should be addressed to the Editor, "THE MODEL ENGINEER," 6, Farringdon Avenue, London, E.C. The last day for sending in is November 30th.

We are pleased to hear that the Sheffield Branch of the Society of Model Engineers has been sufficiently enterprising to engage space at the forthcoming Sheffield Industrial Exhibition for the purpose of showing samples of their members' work. Judging from the particulars of the models to be shown, which are given in the monthly report elsewhere in this issue, we imagine a very interesting collection will be got together. Readers of our journal in the Shetfield district should make a point first of inspecting this exhibit, and then of joining the Sheffield Society.

The recent exhibition of models at the Peterborough School of Science and Art was quite a success, and, indeed, we hear from a reliable correspondent that the collection of engineering and electrical models was one of the best which has yet been shown in the provinces. The exhibits included model locomotives, marine engines, pumps, boilers, gas engines, beam engines, traction engines, model yachts, injectors, and engine parts; among the exhibitors being Mr. F. J. Burnham, Mr. H. Brearley, Mr. W. Eaton, Mr. G. Hayler, Mr. A. S. Turner, Mr. A. Garnett, Mr. T. H. Plowright, and Messrs. Butler Brothers.

F. H. J. (Angelica, New York) kindly sends us a copy of the *Illustrated Buffalo Express*, containing an interesting photograph and description of a model passenger railway located in the Central Park, New York. This is engaged in conveying folk around the park at the rate of five cents a trip. The financial success of this scheme may be estimated from the fact that ten per cent. of the gross receipts go to the park department for the franchise, and more money has been paid into the city from this source already than has been derived in the last half-dozen years from the Manhattan Elevated Railroad.

The diminutive locomotive carries 100 lb. of steam, and goes at the rate of twenty miles an hour, which is the speed of the express trains on the Manhattan L. From the rails to the top of the smokestack of the engine is 18 ins., while the length of the locomotive is 5 ft. 4 ins. The engine weighs 600 lbs. The tender is 3 ft. 5 ins. long, and has to be utilised for carrying the Brobdignagian engineer. He can't move around much as the engine and tender are only 18 ins. wide. The gauge of the track is $12\frac{1}{2}$ ins. The passenger cars are 5 ft. long and 22 ins. wide, and so will hold four little ones. As there are ten cars to a train, forty persons can ride at a time, and the road has two complete train equipments, including baggage cars. The engines burn anthracite coal, and here, as in the case of the licence of the engineer, the law steps in, for soft coal is forbidden to this road, the same as to any steam railway on Manhattan Island. This fact helps to add to the importance of the snorting little engine. It has a whistle and a bell to scare the grasshoppers off the track. "Collision with an able-bodied cat," says the *Express*, "might be as disastrous as running into cows proves to the full-grown locomotive."

Locomotive enthusiasts will find something to interest them in the October issue of Messrs. Geo. Newnes' magazine, *The Captain*. This is a brightly written article, entitled, "Notable Locomotives Past and Present"; the matter being made additionally attractive by a dozen photographs of such prominent engines as the "Lord of the Isles," "Ivanhoe," "Cornwall," and "Lightning." One of the illustrations shows the engine which drew the first train on the Stockton and Darlington Railway in 1825, and another shows the oldest locomotive now at work. This latter engine was built at Liverpool over fifty years ago, and is still running on the Furness Railway.

From Burghersdorp (Cape Colony) "M. H." writes: "I have been a subscriber to your paper since the beginning of this year, and you now seem like an old friend. I assure you I look forward with interest every month to the arrival of the mail which brings my MODEL ENGINEER. In this out-of-the-way part of the world it is about the only means of keeping in touch with the up-to-date electrical news."

The Society of Model Engineers.

THE October meeting of the Society of Model Engineers was held on the 5th of the month, at the Memorial Hall, Farringdon Street, E.C., at 7 p.m. About forty members and friends were present and spent an enjoyable time during the evening. A number of interesting models which were on view attracted considerable attention. These included, amongst other exhibits, a set of steam hammer castings in brass and gunmetal by Mr. Geo. Goodman, a ball lubricator and water-gauge fittings by Mr. Bertrand Garside, a set of model railway signals by Messrs. J. and W. Kean, a print of one of Mr. Avery's "Ironclad" dynamos, etc.

At 8 p.m., Mr. Percival Marshall took the chair, and formal business, which included the election of two auditors, was proceeded with. Messrs. Poole and Loebel were nominated and accepted by the meeting to audit the accounts. Several announcements, many of them in connection with the forthcoming conversazione, were then made by the Chairman, after which Mr. G. BRAINE was called upon to lecture on the "Construction of Model Yachts."

The lecturer, who is a practical exponent of the art, led his audience through the various stages and described the different methods by which a model sailing yacht can be built, even showing how the novice, with no knowledge of design or construction whatever, should set about making his first attempt. The materials, and the way to treat them, were all brought under review, and the lecture illustrated with the actual models, templates and samples of woods employed by Mr. Braine in actual work. A hearty vote of thanks showed that the members appreciated the lecture fully.

Mr. H. S. BOORMAN was then asked to describe a driver-chuck which he exhibited. Having bought a lathe, said Mr. Boorman, which had no driver-chuck, and finding that a suitable one would cost 10s. or 12s., it occurred to him to build one up. The mandrel was screwed $\frac{3}{8}$ -in. Whitworth. A $\frac{1}{2}$ -in. hexagon nut was screwed on the mandrel nose, and turned down until the angles had all been turned off. A $\frac{3}{4}$ -in. by $\frac{3}{8}$ -in. gas reducing socket was then put by the small end in a self-centering chuck, and the thread in the large end turned off until the socket fitted tight over the turned nut. It was fitted together thus, and two $\frac{1}{4}$ -in. screws put right through socket and nut to

make a strong job, and the back end faced up to give a good strong hold. The back of the nut was also turned to give a square seating against the mandrel shoulder. The nut and socket being then screwed on the mandrel in the ordinary way, a piece of steel cut from a cold chisel was screwed to fit the small end of the socket, and, after being screwed in, a point was turned on the end *in situ*. The outside of the gas socket having been turned bright, a hole was drilled and filed square, and a piece of $\frac{1}{4}$ -in. square iron fitted as driver. The chuck was then complete, at a cost (for material) of about 6d. Mr. Boorman's skill was heartily applauded.

Mr. PERCIVAL MARSHALL then gave a short lecture on the subject of screws and screw-making. The various forms of screw threads were described and illustrated, and their method of production by means of chasers and the lathe entered into. The screw-cutting lathe then came under consideration, its features being clearly explained, and the question of change-wheels—generally regarded askance by the turner, amateur or professional—put in a simple and comprehensible light. Considerations of time cut short this instructive lecture, and the meeting shortly terminated.

THE CONVERSAZIONE.

We are pleased to be able to announce that the arrangements for the forthcoming conversazione of the Society of Model Engineers are progressing most satisfactorily. Already nearly forty firms and members and friends of the society have promised to exhibit models or scientific apparatus, and it is probable that many others will consent to assist in this direction. The list of exhibitors includes such well-known names as the Great Eastern Ry. Co., Mr. Thomas Coates, Messrs. Lucas & Davies, Messrs. W. Martin & Co., Mr. Geo. Cussons, The Pittler Lathe Company, Mr. R. J. Lowne, Mr. F. Moore, Messrs. Thorpe & Salter, Messrs. Bassett-Lowke & Co., Stevens' Model Dockyard, The Model Supply Company, Messrs. Marriott & Cooper, Messrs. Paxton & Co., The Crypto Works Company, Limited, Messrs. Butler Brothers, Messrs. Whitney, Mr. Crebbin, Mr. Pearce, Mr. Solomon, Mr. Burnham, Mr. Braine, and many others. Mr. J. Restler, M.I.C.E., engineer to the Southwark and Vauxhall Water Company, has also very kindly consented to show some valuable models made for him by Mr. Thomas Coates. It is hoped that suitable arrangements will be made for working some of the exhibits by means of compressed air. Mr. W. J. Tennant, A.M.I.Mech.E., has promised to deliver a short popular lecture entitled "The Light Side of Science," illustrated by a limelight lantern lent and operated by Mr. Stanley J. Harding. The American Talking Machine Company will, at intervals, give practical demonstrations with the latest Edison phonographs and graphophones, and the Berliner gramophone. Musical selections, both vocal and instrumental, will also be included in the evening's entertainment, so that altogether a most enjoyable affair should result. The date fixed is Saturday, November 11th, and the time is from 7 to 11 o'clock. The Library and Board-room at the Memorial Hall, Farringdon Street, London, E.C., have been engaged for the occasion, and are admirably suited for their purpose. The price of the tickets will be 2s. each, for members and visitors alike, and this will include refreshments, programmes and cloak-room charges. Tickets, and any further information desired, can be obtained from the hon. secretary, Mr. Herbert Sanderson, "The Mount," Ealing, W. Readers wishing to join the Society should send in applications at once.

THE NEXT MEETING.

The next ordinary meeting of the society will be held on Tuesday, November 14th, at the Memorial Hall,

Farringdon Street, E.C., at 7 o'clock. As this will be the annual general meeting of the society, the business will include the election of officers for the ensuing session, the revision of rules, the committee's report on the past year's work, and the presentation of the balance-sheet. All members are invited to make a special point of being in attendance at this meeting.

THE VISIT TO NORWOOD.

A full account of the visit of the society to South Norwood to inspect the model railway made by Dr. Gerald Hovenden and Dr. Arthur C. Hovenden will appear in our next issue. The railway itself is described elsewhere in this issue.

BRANCH MEETINGS.

BRADFORD.—The usual meeting of the Bradford branch of the Society of Model Engineers was held at the Coffee Tavern, Tyrell Street, on Monday, October 9th, 1899. From seven o'clock to eight o'clock the time was employed in an inspection of the models displayed by the members. Mr. A. P. Drake showed a set of boiler fittings, Mr. Cockshott a set of Spicer's $\frac{1}{4}$ h.-p. castings, and Mr. E. C. Prince sent a collection of twenty attractive photographs of various ocean steamships. At eight o'clock, the formal business having been disposed of, the chairman, Mr. A. P. Drake, proceeded to lecture on the subject of "How a Motor Runs." A few questions having been answered, the meeting was brought to a close. The next meeting of the society will take place on Monday, November 6th, 1899, at the Coffee Tavern, Tyrell Street, Bradford, at seven o'clock. In addition to the usual exhibits of models, Mr. J. H. Lamb will lecture on "Model Engine-Building." Readers of THE MODEL ENGINEER who are thinking of joining this branch are cordially invited to attend as visitors.—J. H. LAMB, hon. sec., Holly Bank, Thornbury, Bradford, Yorks.

SHEFFIELD.—The monthly meeting of the Sheffield Society of Model Engineers was held on October 9th, and was well attended. Many members introduced friends, some of whom, at the end of the meeting, signified their intention of becoming members. Mr. Shaw took the chair at eight o'clock. The first business of the evening was the final discussion of the proposed exhibition of models to be made by members at the forthcoming Industrial Exhibition, opened on October 21st in Sheffield. Mr. Shaw presented a plan of the stand engaged, and informed the members that, as he had made arrangements for electric power to be supplied, some of the models would be made more interesting by being shown at work. The collection will include two magnificent locomotives, 8 ft. long, provided by Mr. Knight, a recent member. Amongst the others will be two gas-engines, by Mr. Shaw and Mr. Rooke, Mr. Skinner's marine engine, and a model electric motor car. A number of handbills setting forth the objects of the society will be placed on the stall for the benefit of model-makers who have not yet joined. Above the stand is to be hung a large picture frame containing a dozen photographs of the various works of the members. After this matter was settled many questions were asked, chiefly relating to lathe matters; these produced much valuable information. Owing to the close proximity of the exhibition, not many models were on view, but their place was taken by many interesting photographs. Mr. Prince had kindly sent a dozen of the latter, which were greatly admired. The librarian announced that the library consisted of upwards of eighty volumes, and that he should be pleased to add any book on hydraulics, if such were forthcoming. Mr. Rooke then showed a simple microphone, and announced his intention of giving a paper at the next meeting on "A Domestic Telephone, and How to Construct it." A very pleasant evening was brought to a close about ten o'clock.

Our Beginners' Page.

How to Make a Cheap and Simple Lathe.

By "QUI VIVE."

(Continued from page 217.)

THE flywheel must now be fixed to the crankshaft; the flywheel is built up of three thicknesses of board, as shown in Fig. 14 (section) and 15 (elevation). The first one is 2 ft. in diameter by $\frac{3}{4}$ in. thick; the next 22 ins., and the smallest 20 ins. in diameter, all being the same thickness. Each section should be made as near round as possible, and then the two largest can be screwed together with the grain running in opposite directions; and the third one screwed on with the grain running the opposite way from the second one. This method will make a solid wheel with three different speeds.

A hole the right size for the crankshaft to pass through lightly must now be bored through the middle of the flywheel as truly as possible. It will be as well to bore from both sides, as being more likely to attain this, and it can then be put on the shaft far enough, so that when the latter is in position the right-hand side of flywheel will be perpendicular with the right-hand side of mandrel pulley. This being so, mark the position on the shaft, knock off again, and file the shaft square for about 4 ins. towards the crank. Now make four right-angled blocks as K (Fig. 14 and 15), and screw them to the flywheel as shown, keeping them hard against the square part of shaft. These blocks will not only keep the flywheel true and firm on the shaft, but if the hole in the middle has not been made quite true they will force it to go as it should do, and keep it so.

The treadle must now be made. It is shown in plan in Fig. 16, which is almost self-explanatory. The back bar, L, is screwed on at the outside of the back braces of standards just above the sills, and the treadle hinged to it with a pair of strong flap hinges. The treadle frame consists of the two sides, M, the middle rail, N, and the footboard, O. The sides and middle are 3 ins. by $\frac{1}{2}$ ins., the footboard being 4 $\frac{1}{2}$ ins. by $\frac{1}{2}$ ins., the rails being tenoned into the sides, as shown by dotted lines. The full size of frame should be about 2 ft. 3 ins. long, by 1 ft. 9 ins. wide. The pitman is fixed to the middle rail by means of a staple, and has a hook formed at the other end to fit on the crank (see P, Fig. 16). In length it should be such that when the crank is at its lowest point, the footboard of treadle is about $\frac{1}{2}$ in. clear of the floor.

On turning the flywheel smartly by means of the treadle, it will probably be noticed that it is not exactly round on its periphery. To remedy this, stand a piece of wood close up to it so as to form an improvised rest, and while an assistant treads as fast as possible, by means of very light cuts with a gouge, it can be made perfectly true on each of the three sections. A groove can also be turned on each, as a resting place for the driving gut.

Now place a gut band on the flywheel and round the mandrel pulley (keeping the spindle of the latter firmly up to the conical screw at the left by means of a piece of wood between the lathe centres proper). Then turn the largest speed; the gut can then be removed on to this, and the whole of the pulley turned to the shape shown in Fig. 17, also turning the face of pulley at the right-hand side. On this side must be fixed a piece of good stout sheet brass, as shown in section at R, and in elevation in Fig. 18. This forms a bearing to work against the spindle bearings, so that work can be done on the face-plate, etc., without being obliged to use the poppet; therefore, the movable part of headstock must be loosened and placed

close up to mandrel pulley, where it can be clamped firmly for good. The front end of mandrel spindle must now be filed down wedge-shape, as shown in Fig. 17, first marking the centre of it while the lathe is running, so that it can be filed true. When made right, the sharp edge must be formed into three prongs, as shown in Fig. 19; it will then hold any and all kinds of wood firmly.

It will be a great improvement if a screw is formed on the end of spindle, as shown in Figs. 18 and 19, as this will form the means of not only conveniently attaching a face-plate, but also chucks of various kinds. Before the screw thread is cut, the end of spindle should be filed down and a shoulder formed; this can be turned by driving the lathe very slowly and taking very light cuts with an old three-square file ground up to a blunt point, and will ensure the chucks always being at the same place when used at different times.

The lathe is now complete with the exception of the rest. I will show how to make this and the face-plate, as well as a few useful chucks, in a future paper.

How to Make an Electric Bell.

By A. P. DRAKE.

(Continued from page 219.)

HAVING made the bell, the beginner in electricity will enquire "How is it that the bell will ring?" When a current of electricity flows in a coil of wire placed round a piece of soft iron, the iron is converted into a magnet. When the current is cut off the soft iron immediately loses its magnetism. If, therefore, a current is passed through the bell by connecting a battery to the terminals, we get a circuit through the coils A and B (Fig. 1), through the screw F, the two pieces of platinum, spring E, and to the terminal. The current passing through the coils makes C C into a magnet, and attracts the armature D. When D is attracted toward C C the two platinum pieces no longer touch each other, and so the circuit is broken. The iron C C loses its magnetism, and spring F E brings the armature into its original position. This completes the circuit, and the cycle of operations is repeated. All this takes place very rapidly, and we get the well known sharp ring of the electric bell. The object of the platinum points is to prevent corrosion. When an electric current is switched on and off very rapidly a great deal of sparking and burning takes place at the points of make and break, and platinum is about the only metal which will stand this treatment.

(To be continued.)

Practical Letters from Our Readers.

(The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.)

Steam Raising in Model Locomotives.

TO THE EDITOR OF *The Model Engineer*.

SIR,—My son takes in your paper, and I myself find it very interesting. I have made a model of a Midland Railway single driver bogie engine and tender to about $\frac{3}{4}$ in. to 1 ft., of which, and its railway, you may perhaps

like to know something more later on. My present object in writing to you is to offer your readers a few remarks apropos of the paper by "A Model Stoker," in your October issue, upon the difficulty of getting sufficient heat in the firebox of so small an engine to obtain anything like proportionate steaming power. My firegrate is about 3 3-16ths ins. by 2 7-8 ins., and I find no difficulty at all, excepting (at first) in controlling the large quantity of steam which is produced. In the first place, to get up steam, take a small shovelful, or a 5-in. iron ladleful of broken

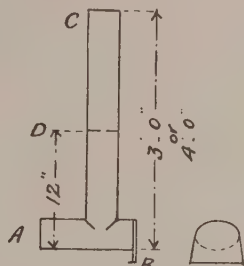


FIG. 1.

charcoal; sprinkle some methylated spirit over it, soaking the charcoal pretty fairly; light the spirit; and when the charcoal shows some red incandescent points, blow upon it with a blowpipe or a small pair of bellows until it is well alight, and then shovel it into the firebox. Next, have ready a temporary chimney (Fig. 1), of which the part A will fit into the fire-door opening, the end B being stopped, and the top, C, open. The part A, B, and up to D should be made of copper. The rest may be of stout brown paper if the object be to make the chimney as light as possible, otherwise, of metal throughout. The bottom part of A B rests upon the footplate, with a support at B to keep it level, if necessary. Put a small piece of sheet

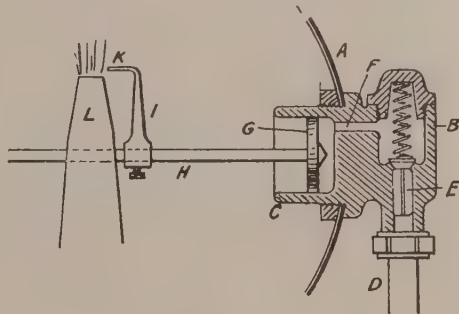


FIG. 2.

metal on the top of the engine chimney proper, to prevent cold air being drawn backwards through the boiler tubes. Fill up the firebox with broken charcoal, dry, and place the chimney in position. In about ten minutes there will be plenty of steam.

Have ready some cooled embers taken from the bright red part of an ordinary open fire left to cool, and broken up to about the size of hazel-nuts. Feed the fire with

these cooled embers when running the engine; they make a strong fire, free from smoke, and lasting much longer than charcoal. If you want the engine to stand under steam for a time, fill up with charcoal and leave the fire-door open. My engine, small as it is, will remain under steam without attention (standing) for an hour, keeping up steam for another run at a minute's notice, if required, when I again feed with cooled embers. Of course, the boiler must be well lagged to obtain this result, all the taps and valves must be steam-tight, and there must be a fine steam-jet in the chimney for drawing up the fire when necessary. Steam blower jets are often made far too large. The prick of a needle through the bottom of a small countersink, drilled nearly through the top of the jet piece, is quite sufficient for engines of this size.

Now, with regard to the regulation of the steam pressure. With a fire newly made up, my engine will, after running about 300 ft., be blowing off, as I judge, twice as much steam as she is using, and a piece of yellow brass put into the fire will melt very quickly. I have, therefore, fixed to one side (A) of the smoke-box a valve-box B (see Fig. 2), combined with an open ended cylinder C. Steam is led from the boiler through a pipe D, underneath the small valve E, held down by a spring, as shown, of such strength as to let the valve rise when the pressure has risen to about 1 lb. or 2 lb. below blowing-off pressure. The steam which passes the valve E enters the cylinder C through the passage F and forces outwards the piston G together with the rod H and the vertical arm I, the top of which (K) is a small flat plate. The latter passes over the top of the exhaust nozzle L, and so baffles the jet of fire. The steam pressure then falls a little, the valve E closes, and a spring (not shown) forces back the rod H. The exhaust nozzle being thus again uncovered, the blast resumes its action on the fire, and the steam pressure again rises. In this way, so long as there is enough fire to keep things going, the pressure varies 1 lb. or 2 lbs. below blowing-off pressure, but the safety valves never blow off.

An older engine than the one I am now referring to used to run a mile round and round a circular railway, with one charge of fuel and water, controlling its own steam pressure in the most perfect manner. The present railway is a viaduct about 200 ft. long, and I have therefore been unable to try a continuous run as above described. The greatest care has to be observed in making small valves, such as E, to act sensitively and promptly, and to be quite steamtight when closed. They are almost in equilibrio, and unless perfectly true and pressed down by a perfectly true spring, friction results, and they remain open or closed too long.

There are several other points about this engine and railway which might interest your readers, and of which I may perhaps send you fuller particulars and photo at some future time, if you would care to devote space to them.—Yours truly,
HENRY LEA, M.Inst. C.E.
Edgbaston.

Flat-Filing.

TO THE EDITOR OF *The Model Engineer*.

SIR,—The accompanying illustration shows a method to enable those who find some difficulty in flat-filing to do so more easily. All that has to be done is to centre-punch the ends of the work (as shown at P, Fig. 2), and place the same between the lathe centres, as shown at A B (Fig. 1). The work must swing freely, so that it may turn on the centres X Y as pivots. The back centre being fixed, start filing on the top surface, and it will be

seen, on reference to Fig. 2, which is an end view of the work being filed, that if the file be held not quite flat the

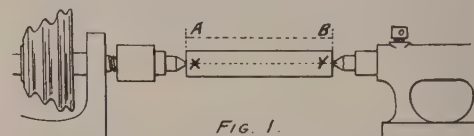
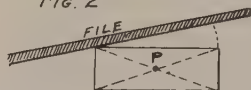


FIG. 2

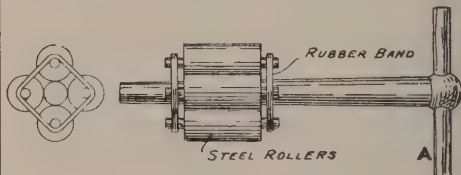


metal will adjust itself as long as it is free to turn on its two pivots.—Yours truly,
J. L. Winchfield.

A Simple Tube Expander.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Below is a rough sketch of tube expander which answered the purpose very well, and is simple to make.



Four steel rollers are fastened to the taper-rod by two stout elastic bands. To use this tool put it in the tube and drive in the taper rod, at the same time twisting it by the rod A.—Yours truly,
J. H. W.

Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips, on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, Farringdon Avenue, London, E.C.1.]

The following are selected from the queries which have been replied to recently:—

[1174] **Wireless Telegraphy.** A. P. (Sudbergh, Yorks.) writes: I have fitted up a wireless telegraph, which acts across a billiard room, using a coil giving less than $\frac{1}{4}$ in. spark, and a coherer sold by S. Bottone. I now want to work it over a distance of about 220 yards. I should be much obliged if you would tell me what size of coil (length of spark) I shall require, and whether a Wimshurst machine can be used instead of a coil, and, if so, what size of plate.

A 1-in. spark coil, or better still a Wimshurst capable of giving, with jars, a good 3-in. spark, will enable you to do all you require. The plates should be about 15 in. diam. For either case you will require a set of three discharging balls, about $1\frac{1}{2}$ in. in diameter. The distance between the balls must be regulated to synchronize the sender with the receiver. For a distance of 220 yards copper rods from 10 to 12 feet in height should be ample.

[1134] **Horizontal Engine.** A. R. (Glasgow) writes: As I am fitting up a model horizontal engine, I would like to know what size piston rod, connecting rod, crank shaft, valve spindle, eccentric rod, to use for it, the cylinder being $\frac{1}{2}$ in. by 3 in. stroke; also what kind of piston ring to use—solid or split—and what steam pressure would be safe, the cylinder being cast iron?

For cylinder 3 in. stroke, $\frac{1}{2}$ in. bore, the following will be suitable dimensions of various parts: Piston rod, $\frac{1}{8}$ in. diam.; connecting rod, full $\frac{1}{4}$ in. diam. each end, 5-16ths in. diam. in middle, 7 in. long centre to centre; crank shaft, $\frac{3}{8}$ in. diam., to be turned down to $\frac{1}{4}$ in. for journals, &c.; valve spindle, $\frac{1}{8}$ in. diam.; eccentric rods, 3-16ths and $\frac{1}{4}$ in. bore. If a piston ring (or better, two) is used instead of cotton packing, which would probably answer better, if (or they) should be made from gunmetal or hard brass sheet 1-16th in. thick, turned a trifle larger than bore of cylinder, and a piece cut out so that the rings "spring" into position. With ordinary well-made cylinders any pressure that the boiler is made to stand will suit the cylinders. Say up to about 40 lb. on square inch.

[1137] **Horse-Power.** F. J. P. (Forest Gate) writes: (1) Will you kindly let me know how many men a 1 h.p. engine would be equal to? (2) Also, how to calculate the power of any steam engine, and, if possible, gas and oil engines.

(1) One horse-power is commonly reckoned to be equal to *sixteen foot-pounds*, horse-power is quite an arbitrary amount, so a man's power is equally indefinite, but 550 foot-pounds per minute may be reckoned as one-man power. (2) The horse-power of a double-action steam engine is calculated from the following formula— $\frac{2}{3} \text{APRS}$

In this formula, A = the area of the piston in square inches, P = the mean pressure during the stroke of piston, R = number of revolutions per minute, S = stroke of piston in feet. This, of course, gives a theoretical result, all the loss by friction, etc., having to be deducted from the total. A single-acting engine APRS would have the formula $\frac{33,000}{2}$ (the result not being multiplied by two). With gas and oil engines, the only point to be observed is the number of impulses per revolution. In the Otto cycle, this is one impulse per two revolutions, and the formula for horse-power will be as in the last case, except that R will be *half* the number of revolutions per minute; the difficulty, of course, being to get the mean pressure in a gas or oil engine.

[1138] **Electrical Engineering.** J. C. (Paisley) writes: I have a great desire to become an electrical engineer, so I write to ask you a few questions about that trade. (1) What is the best way to become a qualified electrical engineer? (2) What subjects should I study at night? (3) What pay does an electrical engineer get? I am at present in an engineering shop as a fitter, and have been there for eight months. You might also state the best book on the subject.

(1) You do not state your age at present time. If you are younger than 16, you should enter at once in the day school of a technical college—in the electrical and mechanical section. A year or eighteen months there would be very useful indeed. At sixteen, or soon after, you should be apprenticed in some electrical engineering workshop, where you should have at least three years turning and fitting. (2) The evenings should be devoted to classes in the theoretical part of your subject, together with mechanical drawing. If you can squeeze in some knowledge of chemistry and physics, also mechanics and mathematics, so much the better. Then at the age of 20 or 21, if you intend to follow the electric light branch of the profession you must get a situation in an electric light station, in some junior capacity. If you go in for the manufacturing side, you would do best to get in an electrical drawing office. (3) In either case you would start at a wage of £1 a week, maximum. Afterwards, everything depends upon yourself. In the ordinary way you should be getting 30s. to £2 in about five or six years later. The best books are "Electrical Engineering for Electric Light and Artisans and Students," by Slingo and Brooker, 12s.; and "Electrical Engineering as a Profession, and How to Enter It," published by Whittaker & Co., 4s. 6d.

[1141] **Torpedo Boat.** T. J. P. (Highgate) writes: I enclose herewith two enquiries which I shall be very glad to have answered. I must take this opportunity to thank you for bringing out THE MODEL ENGINEER, which, to use a rather hackneyed phrase, "complex long and full of it," to me, it is what I have long been looking for and am the proud possessor of all the numbers. (1) I am thinking of making a model torpedo boat 3 ft. 6 in. long, and for engine would use brass tubing as much as possible in order to keep down weight. Would you kindly give the bore and stroke for both single and double cylinder slide valve engines, and say which would be best to use? (2) Would the boiler described in March issue (in article on torpedo boat) be most suitable for work of this kind, or would another be? (3) Could you oblige me with a drawing showing the piston slide valve, with both steam and exhaust ports and pipes marked?

(1) For a boat 3 ft. 6 in. long, a single cylinder $\frac{7}{8}$ in. bore, $\frac{7}{8}$ in. stroke, would probably be most suitable. For a two cylinder engine use $\frac{1}{2}$ in. bore, 1 in. stroke cylinders. (2) The boiler described for torpedo boat destroyer is about the quickest steaming model boiler we have come across. It would certainly suit in your case, we should say. (3) Will not the drawing, Fig. 2, in the first of Mr. Tennant's

articles on the slide valve (April No., 1898), meet your requirement? The piston, slide valve, steam and exhaust ports are clearly shown therein.

[1149] **"Atlas" Gas Engine.** F. F. (Birmingham) writes: Would you kindly tell me if the gas engine described by "Atlas" would be powerful enough to drive a sewing machine, and should be glad if you could answer me one or two questions on it. (1) I do not see what is to stop the gas from escaping up air inlet tube. (2) It says screw a piece of $\frac{3}{8}$ brass tubing 4 in. long in the air inlet hole, and slide a light piece of brass tube, 9 in. long over it. Why would not one piece do? (3) Is there anything special in the gas-bag? Would a football bladder answer the purpose? If you would kindly remove these obstacles I think I can manage the rest.

Yes, the "Atlas" engine is quite powerful enough to drive an ordinary sewing machine. (1) The gas bag, after leaving gas-bag, is practically without pressure, and is drawn into cylinder by suction—exactly as with the air. Between the strokes there is not sufficient time for the gas to diffuse much into air pipe, and what it gets there is drawn in again at next stroke. (3) The sliding tube is for adjustment. It is found that the exact amount of air is a very important item, and the length of the air tube varies in each engine. When the exact length has been found the sliding tube could, of course, be made a fixture. (3) No, there is nothing special about the gas-bag; a football bladder would probably answer very well indeed.

[1150] **Vertical Boiler.** J. W. H. (Leeds) writes: I have two horizontal engines; cylinders, 1-in. bore, 1-in. stroke. I want a vertical boiler to drive both. Would you tell me what size to get, what pressure it will stand, and whether it would be best in brass or copper?

You will need a vertical boiler, 10 in. diam., 18 in. high, with inside firebox, $\frac{3}{4}$ in. diam., 9 in. high. Pressure of about 40 lb. on square inch will probably be suitable, and for this pressure boiler should be made from $\frac{1}{2}$ -in. sheet copper, well rivetted with $\frac{1}{2}$ -in. rivets, 5-6 in. centres. There is little to choose between copper and brass, but on the whole copper is more easily worked, and therefore a trifle more suitable for the construction of a small boiler.

[1156] **Incandescing Platinum Wire.** H. M. (Berks) writes: Could you please inform me what the resulting current in amperes will be if I connect a generator giving 3 volts at 1.3 ampere, and another giving 1.3 volts at 3 amperes together in series, as I want to get 4 volts and as many amperes as possible? How many volts and amperes does it require to heat to a red heat a thin piece of platinum wire about $\frac{1}{4}$ in. long? If I want to do this with an accumulator I have to insert a resistance so as not to injure the accumulator by short circuit?

Since the R of your first cell must be 2.3 ohms as it gives 1.3 amperes, and that of the second 0.44 ohm as it gives 3 amperes, it follows that the amount on the short circuit would be 4.3 volts, and 1.6 amperes nearly. Thus, $\frac{3 \times 1.3 \times 3}{2.3 \times 0.44} = \frac{4.3}{1.6} = 2.74$

The total current would, of course, depend on the resistance placed in the outer circuit. You can incandescence about 1 in. of No. 42 platinum wire with a single cell of accumulator (2 volts) without any additional resistance, and without fear of injuring the cell.

[1188] **Loud-Speaking Telephone.** T. E. R. (Cheshire) writes: I have completed the telephone illustrated in April number, and would like to know the following:—I have a workshop not far from the house, and I have the telephone for speaking to the house. Now, what I want to know is, when they are playing the piano in the house, how can I arrange the telephone so that I can hear the piano playing in my little shop? Would there have to be a special instrument for the purpose, and is it possible for an amateur to make it?

Without any farther adaptation you certainly could hear (if you placed your ear to the telephone in the workshop) the piano playing in any room in the house, provided the transmitter was in the same room. But if you want to hear the piano in the workshop, going close to the receiver, you would have to adapt to the "bell" of the receiver (and by bell we mean the opening against which you usually place your ear) a rather large conical tube, like the wide opening in a funnel. This may be made of tinned iron, and should be about 0 in. long, small enough to fit tightly on the mouth of the receiver, and widening to 5 in. at its mouth. It will greatly enhance the effects if a light piece of dry wood, such as a lath, be held across from the piano to the transmitter, &c., to rest on both. By similar means we have caused persons to hear a musical box which was playing some sixty yards away.

[1329] **Charging Dynamo.** H. C. H. (Chelmsford) writes: Would you kindly tell me the windings and output of small overtype dynamo, which I want to make up for charging 4-volt accumulator. Armature—cog-drum, 1 1/2 in. diam., 1 1/2 in. long; winding space on each magnet, 2 in. by 1 1/2 in. by 1/2 in. thick; yoke, wrought iron, 3 1/2 in. by 1 1/2 in. by 1/2 in. thick.

You should have given shape of armature stampings. Assuming that the armature has 8 slots, 3/4 in. by 1/2 in., you should be able to get about 3 ozs. of silk-covered copper wire on 8 sections, using No. 24 B. W. G. Be careful to thoroughly insulate all parts of dynamo touched by the wire. Wind field-magnets with 3/4 lb. of same wire, and connect in shunt with armature. Output should be from 2 to 1.5 amperes at 8 to 10 volts.

[1760] **Brazing Copper Boiler.** J. F. (Liverpool) writes: I am an apprentice engineer, and since I have taken your paper I have taken a great interest in model work. I am now making a small copper boiler, and I would like you to let me know how to braze it, what metal is used, and what liquid, and what the white powder is, and the name of it. I would like you to tell me where I can get the metal from.

For brazing small jobs the best plan is to have a gas blowpipe with foot bellows. Use "spelter," which is a brass specially made for the purpose, either in the form of wire or large filings. Perhaps some ordinary soft brass filings would suit. The parts must first be cleaned, and then painted with a paste made of powdered borax and water. Then the flame is played on the part (the spelter having been applied) and soon as the heat is sufficient the spelter melts, and runs along the joint. Probably you could get a little spelter from a cycle makers. The powder is borax. (See R. W. on p. 232.)

[1200] **Steam and Exhaust Ports.** C. R. W. (Tollington Park) writes: Will you kindly give sizes of steam and exhaust ports, valve, &c., for slide valve cylinders—(1) $\frac{1}{2}$ in. bore, 1 in. stroke, (2) $\frac{3}{4}$ in. bore, $1\frac{1}{2}$ in. stroke?

(1) Cylinder, $\frac{1}{2}$ in. bore, 1 in. stroke—steam ports, $\frac{1}{4}$ in. wide, 1-16th in. long; exhaust port, $\frac{1}{4}$ in. wide, $\frac{1}{2}$ in. long; bridge between ports, 1-16th in. wide; slide valve, inside, $\frac{1}{4}$ in. wide $\times$ $\frac{1}{4}$ in. (2) Cylinder, $\frac{3}{4}$ in. bore, $1\frac{1}{2}$ in. stroke; steam ports, $\frac{3}{8}$ in. wide, 3-32nd in. long; exhaust port, $\frac{3}{8}$ in. wide, 3-16th in. long; bridges, 3-32nd in. wide; slide valve, inside, $\frac{3}{8}$ in. wide $\times$ $\frac{3}{8}$ in. long.

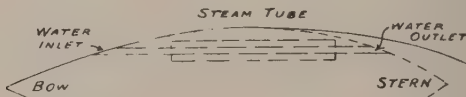
[1205] **Wimshurst Machine; Tram Car Motor.** W. H. S. (Blackheath) writes: I should be much obliged if you could answer the following questions:—(a) Re Wimshurst machine. (1) What should be the diameters of and distances between plates to produce 4, 6, 8 and 10 in. sparks respectively? (2) Has the speed at which they are rotated got anything to do with the length of spark? (3) What is the exact difference between a 6-in. spark produced by a Wimshurst, and a 6-in. spark from an induction coil, as regards volts and amperes, &c.? (4) What size machine would be most suitable for x-ray work, and that usually done by a large induction coil? (5) Would it be better made without sectors and with inter-plate collectors, as described in Vol. II. of THE MODEL ENGINEER, page 32, "Collectors for Wimshurst Machines"? (6) What would be the effect of making the machine described in Vol. I. of THE MODEL ENGINEER, July, without sectors, and providing inter-plate collectors? Suppose the plates, realising room and still be needed. (b) Re Motor described by Mr. Avery in THE MODEL ENGINEER, Vol. II, March and April. (1) Mr. Avery says that at full load it requires 6 volts, $\frac{3}{4}$ amperes. I have a battery of 4 cells, E.M.F. of each cell = 1.5 volts, and R. of each cell = 15 ohm. Would this battery be sufficient, and, if not, how many cells would be required? Please explain by means of Ohm's law. (2) The motor being wound in series, what is the object of winding the field-magnet with No. 20 B.W.G., and the armature with No. 24 B.W.G.? Why should not the magnets be smaller, and wound with No. 24 also?

(a) (1) The plates should, in all cases, run as closely together as possible, without actually touching. You can safely reckon on getting an inch of spark for every 4 in. in the diameter of plates, hence, a 12-in. plate will give 3 in., a 16-in. plate 4 in., a 20-in. plate 5 in. to 6 in., a 24-in. plate 8 in. to 9 in. spark. Something depends on the depth to which the Leyden jars are coated. About 2 in. up a 10-in. jar will give a longer spark (though not so dense) than a coating reaching 5 in. up. (2) The speed of rotation has little to do with the length of spark, but it mostly affects the frequency of the discharges. The plates in a medium-sized machine should not rotate at a higher speed than 200 to 250 revolutions per minute. (3) The electro-motive force in volts is usually much higher in a Wimshurst than in an induction coil, on the other hand, owing to the lesser resistance in the internal circuit, the amperage of the coil is much higher, so that the coil heats more and spoils the x-ray tubes more quickly. (4) A six-plate Wimshurst, 18 in. diam., will do the work beautifully, and quite equal to a 6-in. spark coil. (5) No; because it is then uncertain in action, and apt to reverse. (6) The result would certainly not be any better for all-round work than that of the form described in Vol. I. of THE MODEL ENGINEER. (b) (1) The little motor takes about 3 ozs. No. 24 on armature, and about the same amount of No. 20 in the F.M. bobbins, so that the total resistance in ohms (exclusive of both E.M.F.) is about 2 ohms. Your 4 cells in series, would give, with this motor, current as shown in the annexed equation:— $\frac{4 \times 1.5}{4 \times 0.5 \times 2} = 1.5$ ampère. This would work the motor, but would not give full power, and when the motor is running fast the back E.M.F. would reduce the current yet more. (2) The rule for series winding is to keep the F.M. coils at about two-thirds the resistance of the armature coil, as that ratio is found to give the best results. If the F.M.'s were smaller, the magnetic field would be less.

[1201] **Condenser for Launch Engine.**—N. S. K. (Glasgow) writes: I have a launch engine with two high-pressure cylinders, 3 in. by $\frac{3}{4}$ in. stroke, greatest cut-off 75 per cent., steam pressure 160 lb. per square inch. I am desirous of fitting condenser outside the boat of D-section tubing. What should I require, and is an air pump essential? I have been told it is unnecessary in a small engine. Is this so? Sketch and any information will greatly oblige.

We believe that an outside condenser of D-section tube for a boat

has the disadvantage of not being easily got at for repairs and liability to injury in the event of boat running aground. We recommend the form of condenser sketched below. This consists of a tube running about two-thirds the length of the boat inside, and connected with the water at each end. Outside this tube another

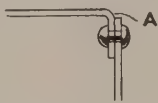


larger tube is fitted with closed ends, into which the exhaust steam is turned and becomes condensed on coming in contact with the cold water tube.

[1320] **Vertical Boiler.** J. P. (Peterborough) writes: Could you kindly supply me with dimensions and thickness of copper for outside shell of a vertical boiler with inside firebox and one flue, to stand a working pressure of 60 lb., and to maintain sufficient steam to keep an engine with a 3-in. stroke working for a considerable time? I would prefer it to burn coal. To what pressure would it have to be tested? What portion of the boiler would be the best for the introduction of the pipe from the force pump? Would it be necessary to strengthen it with stays?

Boiler shell—9 in. diam., 18 in. high, $\frac{1}{8}$ in. sheet copper, 3-16ths in. rivets, $\frac{1}{2}$ in. centres; firebox—height, 9 in., diam. at bottom, 8 in., at top, 7 in.; 13 brass tubes No. 16 B.W.G., twelve 1 in. diam., and one in centre of thicker gauge, $\frac{3}{4}$ in. diam., to have nut at each end. This would keep up a better supply of steam than with one flue. If you decide to have the latter let boiler be rather larger, and the central flue 3 in. diam. We presume cylinder about $1\frac{1}{2}$ in. bore. Such a boiler would burn coal or charcoal, and the exhaust steam from engine should be turned up chimney. Boiler should be tested to 100 lb. The proper place for the introduction of the feed-water is a spot midway between the crown of the flue and the average water level. Yes; it is very necessary to have stays (firebox) in a boiler of this pressure. Such stays should consist of brass wire, $\frac{1}{4}$ in. diam., screwed, with nut each end, and be placed about 3 in. apart in a circle about 3 in. below crown of firebox.

[1321] **Flanging Boiler Plate.** C. T. L. (Tunbridge Wells) writes: I am making a boiler of 1-16th in. copper, something like the one described in No. 2 of THE MODEL ENGINEER, only the firebox top and boiler top are flanged thus:—



I find that when I bend the top as shown in sketch the copper cracks at side marked A. How can I bend same so that it will not crack? Should it be made red-hot before it is hammered? Thank you for past assistance.

Your copper is too hard. Make the sheet red-hot, and have a large dish big enough to take the sheet filled with cold water close handy. When thoroughly red-hot, plunge the copper sheet into the water, when you will find the metal quite soft and workable.

[1239] **Petroleum Blast Lamp.** J. W. E. (Louth) writes:—I have made a petroleum blast lamp similar to the design given by Messrs. The Bickford Burners Company, and illustrated on page 150 of your issue for August, 1898, but am troubled by the petroleum supply pipe and petroleum reservoir getting very hot. When a safety valve in the reservoir lifts, a kind of vapour comes out which seems dangerous. The lamp also makes a loud roaring noise, which I should like to be able to reduce considerably. The pipe from reservoir to coil is $\frac{1}{2}$ in. iron barrel, about 18 in. long, running horizontally. As the above company in their letter offer to kindly answer through the columns of your paper any questions on the subject of petroleum vapour burners that your correspondents may submit, I should take their advice as to getting over the above two difficulties as a great favour.

The heating of the oil in the tank is due to the surging of the oil from the burner to the tank, and can be stopped by checking this, which can be effected in two ways. Either by putting a tight roll of fine wire gauze, or a bundle of parallel wires in the supply pipe to act as a check on the flow of the oil, or by increasing the length of the supply pipe, and at the same time diminishing its bore. As for instance by using $\frac{1}{2}$ -in. bore copper pipe, and coiling up a considerable length of it. In our opinion the escaping vapour is not

dangerous. An explosive mixture of petroleum vapour and air in a room is as thick as wool, and is so heavy that it appears to flow about like a liquid. At the same time the escape of this vapour smells badly. We are of opinion that there is no known means of checking the noise of a plain jet burner, and at the same time to keep a blue flame. Any means which makes the flame yellow checks the noise.

[189.] **A.W.M. Motor.** R. E. (Newbury) writes: As I intend making the A.W.M. electric motor, design No. 2, will you kindly inform me on the following:—(1) Instead of building up the F.M. with a number of iron plates I propose having it cast in one piece, as I am, at present, able to get small castings done at a cheap rate, and I think it would not be so much trouble as to build it up. Would there be any disadvantages in this method? Would ordinary cast iron do well for the work, and should I have to anneal it or submit it to any softening process? Should I have to alter the winding in any way? (2) What dimensions of boat would suit it

doubtless justify the means adopted, as it is quite certain that amateurs fully appreciate being able to see a correct representation of the articles they require before purchasing. At any rate, there are over 300 cuts in this list, hardly a page being without an illustration of some useful article or other. Most readers will remember some remarks in these pages a little while ago in reply to a correspondent who objected to pay a small charge for the catalogue he required, our contention being that advertisers were quite justified in making such a charge to protect themselves against useless enquiries, and that, in most cases, they would willingly refund the cost of the catalogue to *bona-fide* customers. We are glad to note that Messrs. Stevens have given this point their consideration, and they have accordingly instituted a coupon system, which seems likely to solve this question in a simple but effective fashion. Inside the cover of their new list is printed a coupon, which, if cut out and returned with an order for goods to value of 2s. 6d. or upwards, will ensure the return of the 3d. paid by the sender for the list in the

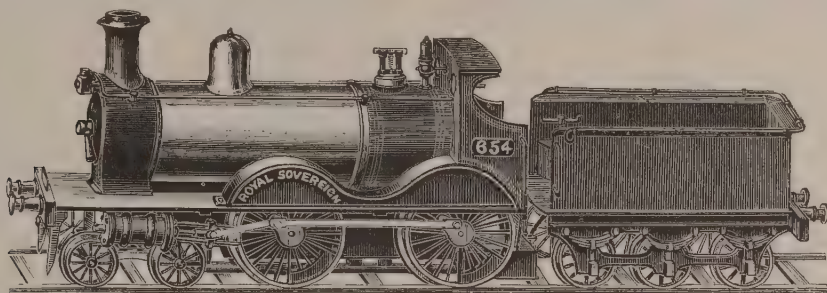


FIG. 1.

best? and, provided plenty of battery power was available, what size and pitch of propeller should be used?

(1) The field-magnets can be cast, but must be soft iron. This can be attained by thorough annealing. The stampings make a rather more efficient machine. Leave winding same as that described. (2) A boat 4 ft. 6 in. long, $7\frac{1}{2}$ in. beam, and 7 in. deep, would be suitable. Propeller, 4 in. or $4\frac{1}{2}$ in. diam., 6 in. to 8 in. pitch.

TO MANCHESTER READERS.—In response to the paragraph inserted in the October issue of **THE MODEL ENGINEER**, asking readers in the Manchester district to communicate with Mr. S. L. Thompstone with a view to forming a branch of the Society of Model Engineers, about a dozen replies have been received. Now that active steps are being taken to set this branch going, Manchester readers are urged to send in their names at once to Mr. Thompstone, whose address is 27, Nelson Street, Lower Broughton, Manchester.

MR. A. P. DRAKE, whose description of a small electric car motor appeared in our September issue, writes to point out a mistake in the drawing. As it now stands, the rails (which convey the current) are obviously short-circuited through the metal driving axle. The original, Mr. Drake explains, had this axle in two parts, which were joined by a sleeve or coupling of wood. The two axle ends were driven into this wood a certain distance, but did not meet, so that there was no metallic connection; the coupling was unfortunately omitted from the drawing.

Amateurs' Supplies.

[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.]

The Latest from Stevens' Model Dockyard.

In preparing their new illustrated catalogue of model engines, ships, fittings and scientific novelties, Messrs. Stevens have undertaken a somewhat expensive and arduous task, as may be gathered from the fact that the number of illustrations has been more than doubled in the new list just issued. However, the results will

first instance. We think nothing could be more simple or fair than this arrangement, and we have no doubt it will be duly appreciated by the firm's numerous customers. Among the features of the new list we notice some high-class scale model racing yachts, both *Britannia* type and double fin keel boats; hulls for model screw and paddle steamers, which may be had in various stages of finish; a full set of illustrations and prices of model sailing and steamship fittings; direct-acting marine screw engines; a full set of illustrations of parts for model marine, stationary and locomotive engines; pressure gauges; dynamos and motors; electric bell sets; microscopes; cameras; magic lanterns; and a very com-

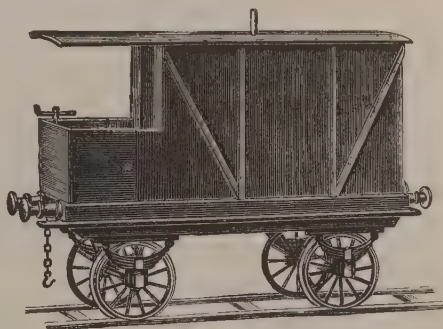


FIG. 2.

plete list of useful books. As to locomotives, there are some sixteen types of engines illustrated, several of the pictures being direct half-tone reproductions from photos. We give herewith an illustration of the *Royal Sovereign* slide-valve locomotive (Fig. 1), with coupled driving wheels and leading bogie. The total length of this engine is 25½ in. We also show (Fig. 2) a well-made polished mahogany brake-van, which is produced in three sizes, 6½ in., 8½ in., and 11 in. long respectively. Other railway items in this list include signals, lamps, passenger carriages, goods trucks, rails, &c. In model ship fittings and in model engine fittings of the best quality this firm are specialists, and they do an extensive business in these goods, as a

glance through their list will show. The new catalogue may be obtained post free for 3d. on application to Stevens' Model Dockyard, 22, Aldgate, London, E., and is well worth writing for.

A Neat Pocket Calculator.

Now that the slide-rule has become almost a necessity in drawing office work, in estimating, and in a variety of other ways, a portable form of it is a great desideratum. This is supplied in one of its neatest and simplest forms in the "Mechanical Engineer" Pocket Calculator, which, as will be seen from the illustration, is not unlike a watch in appearance. The simplicity of the apparatus consists in the fact that it is only necessary to turn two nuts, the instrument "doing the rest." There are five circles of figures on the dial, and the various calculations are made with the aid of one or more of these for each operation. With a very few minutes' practice, by the aid of the printed instructions, troublesome calculations can be worked out to a fine degree of accuracy, and it really only needs an actual trial to convince one of the general usefulness of the instrument. Add to its portability and simplicity the advantage of its moderate price, it certainly should be in the hands of all smart



engineers, draughtsmen and students. All information on the subject of the Pocket Calculator can be had from the Scientific Publishing Company, Hodson's Court, Corporation Street, Manchester.

A Small-Power Gas Engine.

The demand for small-power gas engines is now so great that the supply is constantly being augmented by new designs, although the standard Otto-cycle appears to hold the field against all comers. The new one-sixth h.p. horizontal gas engine made by Messrs. Bentley & Co., Henry Street, Derby, keeps to this type, but lays claim upon public attention in the matter of simplicity of its working parts. The bore of cylinder is 2 ins. and stroke 3½ ins., and the engine runs at a high speed—700 to 800 revs. per minute. All the engines are tested before sending out, and sets of castings are supplied at reasonable rates. Particulars may be had of Messrs. Bentley & Co., as above.

Model Railway Signals.

We have received a set of samples of working model railway signals, which are being placed on the market by Messrs. J. & W. Kean, 2, Castilian Terrace, Northampton. These vary in design from a single-arm signal with a 9-in. post, to a complete signal with two posts rising from one ground post, each post carrying a lamp and a signal arm with spectacles, and having proper ladders affixed. The signal arms are weighted, and are worked from levers in notched quadrants at the base. The posts and bases of these signals are made of wood, while the lamps, of course, are only dummies. However, the colouring and general effect of all the patterns is very good, and it should be noted that they are correctly modelled according to the standard types of signals adopted on the Great Western, Midland, and London and North Western Railways respectively. The prices are very low, ranging from 6d. up to 6s., according to the style of signal required. Full particulars on this and other points can be had by writing to Messrs. J. & W. Kean, who will be pleased to give further information on application.

Talking Machines.

Amateurs who are making their own talking machines, and who want any parts or supplies, or practical advice, may be glad to know that they can obtain same from The American Talking Machine Company, 32, Glendavon Street, Putney, London, S.W. This company are also willing to exchange machines, and as they have a good assortment of the very latest types of phonographs, gramophones and gramophones, readers who want to exchange their present machines for something newer would do well to com-

municate. Correspondence on the above points is invited, and letters stating the senders' full requirements will receive prompt attention.

Catalogues Received.

Clyde Model Dockyard, Argyle Arcade, Glasgow, N.E.—In view of the new approach of the season when "presents" are the order of the day, the Clyde Model Dockyard has issued a special list of goods for the purpose. Perhaps the most special feature of this list is the fact that a considerable number of the items are marked at reduced figures, although the goods will be quite up to standard. Steam engines, locomotives, electro motors, batteries, accumulators, coils, signals, and, of course, boats and model yachts, are amongst the goods listed, and we have no doubt the list will quite serve its purpose. It will be sent free on application, THE MODEL ENGINEER being mentioned. The complete price list of the firm's goods, fully illustrated, containing about 50 large pages, can be had for 3d., post free.

A. G. Thornton, 68, St. Mary's Street, Manchester.—Two attractively printed booklets reach us from this well-known firm of mathematical instrument makers. One, it is true, is made up *only* of testimonials; but they are convincing in their unanimity and satisfaction. The second is an illustrated list of drawing instruments of all degrees and classes. The only difficulty one would have in selecting from this list is the difficulty of choice amongst so many good things. The lists will be sent post free to any reader.

Morley & Cooper, 70, Upper Street, London, N.—Magic lanterns will be playing a considerable part now in many of our lives, and Messrs. Morley & Cooper are to the fore with descriptive leaflets of some of these instruments and accessories, besides a number of hand cameras of all kinds and at all prices. MODEL ENGINEER readers should mention the paper when making enquiries.

A. C. Thomas, 84 & 85, London Road, Dover.—This is a brief list of battery zincs for various forms of batteries. They appear to be cheap, and as all are quoted for, and the weights given, the list should prove a useful one in the hands of the amateur.

C. A. Vandervell & Co., Thorpe Works, North Kensington, London, W.—This reliable accumulator firm announces by a leaflet just to hand that a cheaper class of 4-volt curved pocket batteries is now being supplied. Special discounts to the trade and large buyers are offered, and the makers guarantee every battery sold. Readers should write for prices and particulars.

L. Ford, Electrical Engineer, 55, Market Street, Stalybridge.—The fourteenth edition of Mr. Ford's electrical list lies before us, and is a well-arranged catalogue of sundries dear to the amateur's heart. Dynamos, water-motors, accumulators of all kinds, gas and oil engines, are amongst the things dealt in, and MODEL ENGINEER readers will find the list full of interesting matter. Post free 1½d.

Notices.

The Editor invites correspondence and original contributions on all matters of a technical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 3s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All correspondence relating to advertisements to be addressed to the ADVERTISEMENT MANAGER, "The Model Engineer," 6, Farringdon Avenue, London, E.C.

All subscriptions and correspondence relating to sales of the paper to be addressed to the publishers, DAWBARN & WARD, Limited, 6, Farringdon Avenue, London, E.C.

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 12, Courtland Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

THE
Model Engineer
AND
Amateur Electrician.

A JOURNAL OF MECHANICS AND ELECTRICITY FOR AMATEURS AND STUDENTS.

EDITED BY PERCIVAL MARSHALL. A.I.MECH.E.

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**Models of Locomotives in
Cardboard.**

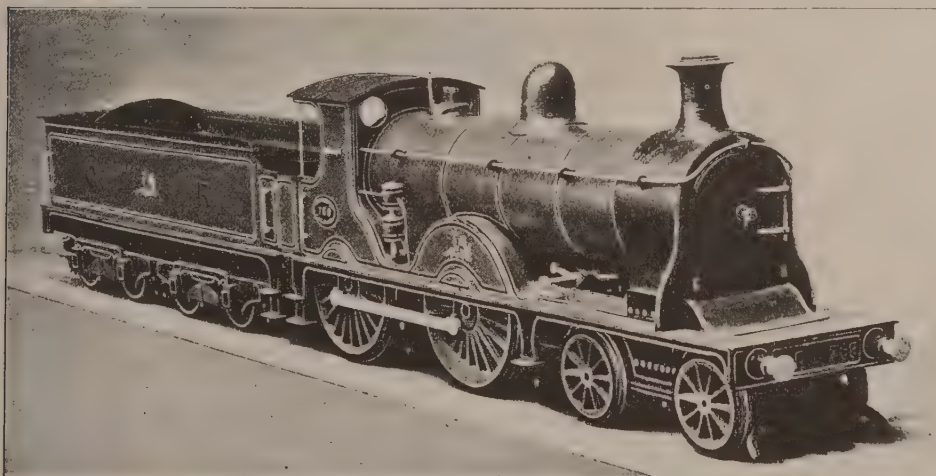
By JOHN G. HYDE.

THE following description and accompanying photograph of a loco model I have made out of very simple materials, and with very inexpensive tools, may perhaps be of interest to some who intend to take up

printing and publishing works for about 6d. per large sheet, about 3 ft. sq. It is from 1-6th to 1-5th in. thick, and will take rather a coarse fretsaw without any difficulty.

The boiler, footplate, cab-roof, &c., and any parts which have to be curved are made of thinner sheets (costing about 2d. per sheet) which can be easily cut out with scissors and a sharp pointed knife.

My first attempt was a Midland Railway 7 ft. 6 in. single locomotive, and I have since regretted that I was not more careful in the first stages of its construction,



CARDBOARD MODEL OF CALEDONIAN RAILWAY LOCOMOTIVE.

model making as soon as they can obtain suitable appliances. If it should induce them to try their hands at anything similar in the meanwhile, they would not, I think, find their time altogether wasted, as they would get practice in making their models correct in proportions and realistic in appearance.

My models are made of "strawboard" principally, a kind of thick cardboard which can be obtained at any

having at that time no expectation, or indeed intention, of turning out anything having more than a distant resemblance to a locomotive; I had no measurements, and merely guessed at the proportions with the aid of a photograph. I have therefore got the frames and smoke-box a trifle too long, the cab too high, the boiler pitched too low, and the dome too large; and, though it has more or less a "Midland" look, I cannot but feel that scant jus-

tice has been done to a masterpiece of our most artistic locomotive designer.

I selected one of the celebrated "enlarged Dunalastairs" of the Caledonian Railway for my next attempt, and was careful this time to get measurements as well as photographs.

Both engines are on a scale of one inch to a foot, the C.R. engine being pretty exact, considering the materials used. The inside or main frames are cut out of the thick boards with a fretsaw, wooden stays being glued between; the outside frames of the Midland engine are also of thick board, those of the Caledonian engine being cut from the thin sheets. The boiler is easily made by bending the thin sheets to the right size and fixing an inside strip to hold the edges together; discs of thick board are glued inside to keep all firm; and the front and back plates of both fire and smoke boxes are sawed out of the thick board.

The wheels are made of three thicknesses of the thick board and are simply glued in their places. The chimney, dome, &c., are made by glueing suitable pieces of wood to the boiler, and building up with clay, making all firm with glue. The Midland engine is painted "plum red" with black bands and yellow lines, and the Caledonian dark blue, with black bands and white lines, frames chocolate, with black edge and white line.

The handrail is a piece of wire clothes line, and many little odds and ends can be utilised in making the smaller fittings.

The photo of the Caledonian engine was taken by Mr. Chas. H. Evans, of the Gainsborough Studio, 12, St. Helen's Road, Swansea.

How to Ring Two Electric Bells in Series.

By F. E. P.

IT is very generally supposed that to make one push ring two electric bells satisfactorily, the latter must either be wired in parallel or one of the bells must have a special attachment, if they are required to ring in series. It is quite true that when two ordinary bells are wired in series, without any internal alterations, their ringing is spasmodic or irregular, and far from satisfactory. If, however, the following simple instructions are followed, two or any number of electric bells can be made to ring clearly and regularly, connected in series, provided sufficient battery power is forthcoming, and much better than by the aid of any special appliance.

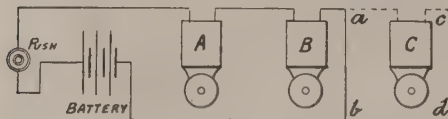


FIG. 1.—DIAGRAM SHOWING NEW METHOD OF CONNECTING UP BELLS IN SERIES.

The principle on which this plan is founded is a very simple one, and its mere statement will be sufficient guidance for those who have practical knowledge of bell fitting. It is simply to let the first bell do the contact breaking for the whole set.

For those who do not at once see what this means, I will briefly describe the fitting up of two bells, to be rung

in different rooms at the same time by one push and one battery. It is presumed that the reader is able to fit up battery bells and push in the ordinary way. The first bell A (see Fig. 1) may be fixed in position without any alteration, supposing it to have been tested and found to ring all right. Then take the second bell, B, and make the following alterations in its internal connections.

Referring to Fig. 2, the usual course of the electric current is *via* terminal T_1 , wire b , contact breaker C, spring S, wire w , through the coils of the electro-magnet M, and out by wire W to second terminal T_2 . It is required to cut the contact breaker out of circuit altogether. To do this, disconnect the wire w from the spring

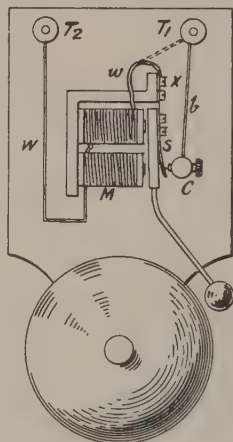


FIG. 2.—SHOWING ALTERATIONS NECESSARY TO CONNECTIONS IN BELLS TO BE RUNG.

S by undoing the screw at X which holds it. If this wire w is long enough it may at once be connected to terminal T_1 , as shown by dotted line, and the wire or brass strip b , which connects T_1 and C, may be at the same time removed. If w is not quite long enough, it should be joined to another short piece of wire (the joint being soldered), and connection thus made with T_1 .

It will now be seen that the course of the electric current entering at T_1 is altered, and instead of passing through the make-and-break arrangement, the flow is direct through the coils of the electro magnet M and out at T_2 . The bell may now be fitted up as at B (Fig. 1), and the wires connected as shown in the diagram. A little reflection will now show that as fast as the current is interrupted in A, causing that bell to ring, it is at the same time being interrupted in B. The effect on the magnet and armature of B is precisely the same as on A, and B will ring "in tune" with A, or synchronously.

Obviously, as the resistance of two bells is in circuit, more battery power will probably be required to work them than would suffice for one. Under ordinary conditions, however, two quart Leclanchés will be found sufficient. If a third bell be treated like B, it may also be put in series in the same way, and such an arrangement is shown by dotted lines at C. In this case the line ab is, of course, omitted, the line cd taking its place.

New readers of THE MODEL ENGINEER would do well to secure as many of the back numbers as are in print without delay, as these are being rapidly exhausted.

Liquid Fuel Burners for Model Boilers.

By "A MODEL STOKER."

(Continued from page 205.)

A DESCRIPTION of the system adopted in the model cruiser *Tyress* described in the August issue of *THE MODEL ENGINEER* may be of interest.

Referring to the engraving (Fig. 4), the naphtha is contained in the tank R. Submerged in it in such a manner that it may be readily withdrawn for inspection is the naphtha pump A. The plunger—3-16ths in. diameter, greatest stroke $1\frac{1}{2}$ in.—is lifted by the chain P and the rocking beam U by the engine, or by hand in starting, by the stem S. The down, or forcing stroke, is made by two springs (T), which are so proportioned as to give a pres-

pump is worked by hand. The vapour lights from the torch and the hand pumping is continued until there is steam enough to start the engine, which is usually in about a minute and a half; after this the engine works the pump. The proportions of the burner are the result of no little experiment. The tank holds about 2 lbs. of the 76 deg. deodorised naphtha used.

The illustrations on the next page (Figs. 5 and 6) show the boiler of a model Great Northern Locomotive made by Mr. J. H. Bryant, and the oil burning attachment he has fitted thereto. The drawings are very clear and need no explanation.

How a Battery Works.

THE first practical step in the career of the electrical student is generally the construction of a galvanic battery, and the interest of the subject never flags throughout his electrical career. The only serious rival in

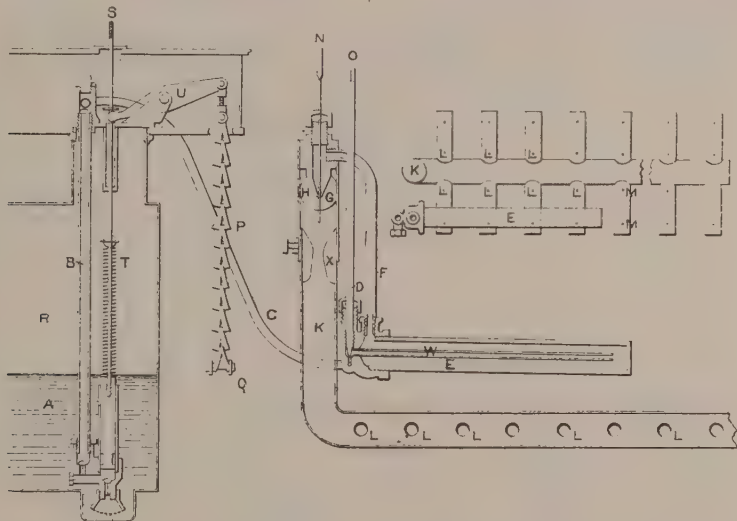


FIG. 4.—LIQUID FUEL BURNER FOR MODEL CRUISER.

sure of 40 lbs. per sq. inch. Should too much naphtha pass into the retort, or the regulating valve be closed, this pressure is exceeded, and the plunger simply stands up, being held by the back pressure. When this falls it goes to work again, thus its action is automatic. By the pump the naphtha is forced through the pipe C, regulating valve D, and inner pipe into the retort E. Here it is vapourised, and rises through the pipe F, and passes through the annular opening—less than $\frac{1}{16}$ in.—between the needle N and the orifice of the nozzle at G. The needle N may be worked up and down to clear out any obstruction that may lodge here. The rush of vapour through the contracted throat below draws in air at H by induction, and, mixing with it, the combination issues at some forty openings in the branch pipes L, each about $\frac{1}{32}$ in. diameter, and burns in long blue smokeless jets among the boiler tubes, the lowest of which are $\frac{3}{8}$ in. above the burner. In getting up steam an asbestos torch dipped in alcohol is lighted and inserted under the retort. When this is sufficiently heated the regulating valve is opened, and the naphtha

his affections is the dynamo—certainly a formidable rival—but when dynamos are out of the running, the battery reigns in unquestioned supremacy!

Most of the commoner types of primary batteries are so well known that a special description is not here necessary. A few plain words to give the novice an idea of the changes which take place in a galvanic battery will not be out of place, and may save time and trouble. The following is not a deep analysis of the theory, but rather a plain statement of some of the known facts.

You are probably aware, from observation, that any form of galvanic battery shows signs of chemical action. The most usual proof of this is the gradual eating away of the zinc plate or bar by the acid. In other words, the zinc and sulphuric acid have united to form the chemical compound, sulphate of zinc. As a result of this action a certain amount of "force" is set free, and is manifested in the battery, partly in the form of electric energy (which can be conducted away for use by means of wires) and partly as heat which warms the fluid in the battery and is lost for all practical purposes. Whether electricity

is always developed when chemical action takes place is a moot question, though it is likely that if conducting materials could be conveniently arranged, every chemical change would be found to be accompanied by electrical manifestations. At present, all we have to consider is the chemical action in the ordinary forms of battery.

An experiment—too delicate for the amateur to attempt—shows that when two perfectly clean, dissimilar pieces of metal, such as copper and zinc, are brought into contact, an electrical state is induced in each metal, the zinc showing a positive (+) and the copper, negative (-) electrification. A similar result occurs when a metal is brought into contact with acid solutions. Thus, if zinc be brought into contact with sulphuric acid, the zinc becomes negatively electrified. The same result occurs

wire connects the copper and zinc plates, the acid will continue its action on the zinc until either acid or zinc is exhausted.

"But," it will be said by some of you, "both plates are negatively electrified, and yet you expect a positive flow of electricity from the copper to the zinc." An analogy is the best way to clear up this point. Imagine two equal vessels, from each of which the air has been partially exhausted, but from one (A) twenty times as much air has been taken as from the other (B). Now connect A and B by a tube. You see at once that although both vessels have less than the normal pressure of air, that is, both have negative pressure, yet a current of air will undoubtedly flow from B to A until there is an equal pressure of air in each; in other words, until both have equal

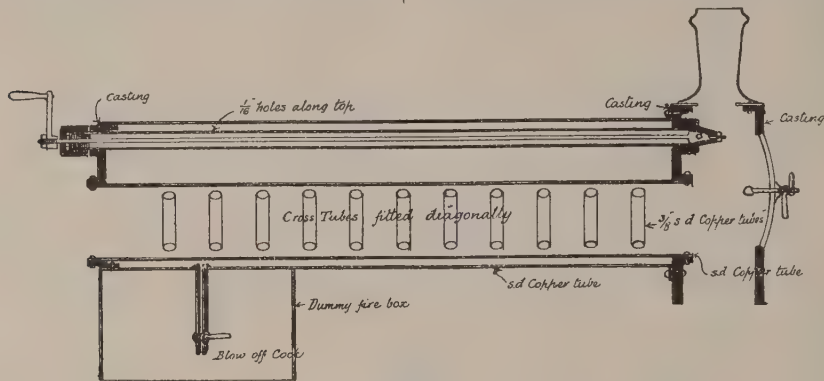


FIG. 5.

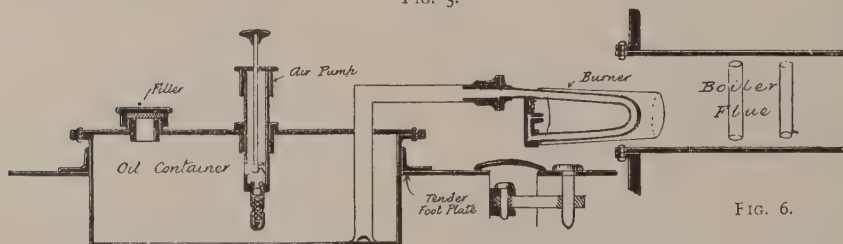


FIG. 6.

FIGS. 5 AND 6.—BOILER AND OIL-BURNER FOR MODEL GREAT NORTHERN LOCOMOTIVE.
(See page 251.)

when copper is in contact with sulphuric acid, only that in the latter case, the amount of negative electricity induced on the copper plate is enormously less than that on a similar zinc plate. Now, suppose a copper and zinc plate to be immersed (without letting the plates touch one another) in a sulphuric acid solution. What happens? The zinc plate immediately becomes strongly charged with negative electricity, and the copper plate weakly so. As long as the plates remain unconnected, and the zinc is pure, no further action takes place; but if a wire be made to connect the plates outside the acid solution, the tendency which dissimilar electrical charges have to neutralise one another causes a flow of negative electricity through the wire from zinc to copper and a positive flow in the opposite direction. The "static" charge being thus disposed of, a fresh charge is given to the plates by the action of the acid, which commences to dissolve the zinc as long as the

"negative charges" of air. It is quite possible, therefore, if the analogy is clear, for two plates to be relatively positive and negative to one another, and yet both of them negative (or it may be both positive) when viewed in relation to ordinary so-called unelectrified objects.

The acid solution plays a second important part in a battery besides inducing the first electrical charge in the zinc. If pure sulphuric acid were used, the first action—the production of an electrical state of the zinc plate—would be the same, but when the plates were joined by the wire (usually called the "outer circuit") the current would soon cease. The reason for this lies in the fact that the sulphate of zinc, which is the compound produced by the acid plus the zinc, being insoluble in pure undiluted sulphuric acid, remains on the surface of the zinc plate. As this sulphate of zinc is also a non-conductor of electricity, it acts as a protective agent, and no

further electrical charge can be induced until it is removed. The addition of water to the acid has the effect of allowing the sulphate of zinc to dissolve, and the zinc plate is left free for further action.

The foregoing serves to show the reason why a battery develops electrical energy, but it does not indicate how a battery should be made up to give the best results. This should form the subject of a separate article, but here it may be briefly stated that while a given pair of metals—say, zinc and copper—immersed in a solution of sulphuric acid of given strength, will give a certain pressure or voltage of electricity, whatever the size of the cell, the absolute quantity of electrical energy obtainable depends on two things—the size of the plates and their proximity. Dilute sulphuric acid is a comparatively poor conductor of electricity as against the conducting powers of metals. It is, therefore, advisable to make your cells and plates as large as possible, and to have the latter as near together as circumstances permit, but never nearer than $\frac{1}{4}$ in., so as to allow of the free escape of the gases generated in working.

For the Book-shelf.

[Any book reviewed under this heading can be obtained from THE MODEL ENGINEER BOOK DEPARTMENT, 6, FARRINGTON AVENUE, LONDON, E.C., by remitting the published price and cost of postage.]

MAGNETISM AND ELECTRICITY. By J. PALEY YORKE. London: Edward Arnold, 37, Bedford Street. Price 3s. 6d. Postage 3d.

This book deserves recommendation for the general excellence of the illustrations, which mark a great advance in the matter of clearness on those of the text-books of a few years ago. The only exception we feel bound to take in this matter is in regard to the drawing of an electric bell on page 97, which is rather clumsy in form. The author does not appear to have departed very strikingly from recognised paths, but the ground is well covered, and the matter very readable. A set of questions is provided in the appendix, and as the book is intended for class use, along with practical experimenting, the somewhat brief descriptions and explanations would be considerably amplified during the student's course of study. Mathematical formulae are almost entirely eliminated.

A TEXT-BOOK OF PHYSICS. By W. WATSON, A.R.C.S., B.Sc. London: Longmans, Green & Co., 39, Paternoster Row, E.C. Price 10s. 6d. Cloth. Postage 5d.

A good knowledge of physics is an important item in the scientific equipment of an engineer, since so many points in engine and machine design are dependent on the physical truths and laws involved. The term "physics" covers a wide range of science subjects, but these may be suitably grouped together, as is done in this book under the headings Mechanics and Properties of Matter; Heat; Wave-motion and Sound; Light; and Magnetism and Electricity. These subjects are, of course, treated separately in almost countless text books, but it is a matter of great convenience to the student to have the whole ground explained to him in one volume. The renowned work of Ganot has for many years been the standard book on physics; but since the days of Ganot scientific knowledge and methods of teaching science have made much progress, and hence the volume before us is likely to be a strong candidate for favour on account of its being thoroughly modernised both in matter and in method. However, Ganot is not entirely superseded, as several of his illustrations are borrowed and acknowledged by Mr. Watson. The author has wisely adopted

such an arrangement of the contents as ensures that everything taken for granted in one section has already been fully demonstrated in a previous section, so that the elementary student who carefully works his way through the book always finds himself equipped with the necessary information to deal with the various propositions and explanations as they are laid before him. Moreover, the mathematics employed in demonstrating the propositions are of a very simple character, and the elementary portions of the subjects touched upon have been treated at sufficient length to obviate any necessity for reference to other books. The following selection from the subjects dealt with will indicate the scope of the book:—matter and energy; physical quantities and measurements; motion; work; machines; friction; gravitation; properties of matter, gases, and liquids; thermometry; calorimetry; conduction and radiation of heat; mechanical theory of heat; wave-motions; production and propagation of sound; vibrations of strings, rods, plates, and columns of gas; reflection and refraction of light; lenses; photography; colour sensations; polarisation; magnetism; static electricity; the electric current; resistance; thermo-electricity; induction; voltaic electricity; electro-magnetic theory. There are over nine hundred pages and over five hundred illustrations, the majority of the latter having been specially drawn for this work. Although the ranks of science text-books are so crowded, we believe there is plenty of room for so carefully written and well-produced a volume as this is, and we think it will speedily win for itself a deservedly high and wide-spread reputation amongst both teachers and students.

PHOTOGRAPHS OF THE YEAR 1899. Published for The Photogram, Limited. London: Dawbarn & Ward, Ltd., 6, Farrington Avenue, E.C. Price—cloth, 3s.; paper, 2s. Postage 5d.

So many of our readers are themselves photographers, or are interested in photography, that we are glad to be able to introduce to their notice a very bright and enjoyable record of the work done by their brethren in the craft during the current year. It is, of course, true that the engineer is not properly the best critic of the artistic value of photographs (or, photograms, as they are here called), but we can, at least, say we like these pictures immensely, and are confident our photographic—and other—friends will like them too. As a record of the work shown at the two important photographic exhibitions of the year, the volume is invaluable. In this respect it is to the photographer what the art annuals are to the artist. The printing, paper, and binding are admirable. We refer, in the latter case, to the cloth edition, this being in a strong, greyish binding, very attractive, and well worth the higher price. "Photograms of 1899" would make a unique and tasteful Christmas present.

NOTES ON THE CONSTRUCTION OF CRANES AND LIFTING MACHINERY. By EDWARD C. R. MARKS, A.M.I.C.E., M.I.Mech.E., F.C.I.P.A. Manchester: The Technical Publishing Company, Limited, 33, Whitworth Street. New and enlarged edition. Price 3s. 6d. nett. Postage 3d.

We cannot overrate the importance that attaches to the possession of a good reference library by the young engineer. One is often able to get access to good libraries or books belonging to somebody else, but it should need little emphasis to prove the value of one's own bookshelf. In the first place, the books are to hand at a moment's notice. Then, again, if the volumes have been selected with a definite view to be useful in one's special work, there is probably no need to refer even to the index, and a reference can be made without the least delay. Good representative books should be chosen, and it would be

an excellent plan if the apprentice or young beginner who "means business" were to set aside a small sum periodically for additions to his engineering library. And one of his purchases might well be the book which now lies open before us. Its subject is one which probably suffers contempt at the hands of most people, because of its apparent familiarity, but considering the dependence of the engineering and other trades on the "lifting machine," such contempt is surely out of place. The author of this volume reminds us of the enormous range which the title properly covers, and rightly remarks that a subject of such magnitude cannot be fully treated in so limited a space. But he is almost too modest. There is no "padding" in his book, and the large number of examples chosen and illustrated are presented in a concentrated form, which is very handy, to say the least. The practical calculation of strains and stresses in the different types is dealt with in a simple manner. Hydraulic cranes and appliances are left out of consideration entirely, and the mass of the book deals with hand and steam machinery, three chapters being devoted to modern electrical appliances.

FOWLER'S MECHANICAL ENGINEERS' POCKET-BOOK FOR 1900. Edited by WILLIAM H. FOWLER, Wh.Sc., A.M.I.C.E., M.I.Mech.E., &c. Manchester: The Scientific Publishing Company, 2, Hodson's Court, Corporation Street. Price 1s. 6d. Postage 3d.

If there were any reader of *THE MODEL ENGINEER* to whom this pocket-book would not appeal, we should be very much surprised. It is hard to think of any engineering subject not dealt with—and that in a really clear, practical way—between its covers, as a very cursory glance at the excellent index will show. When we state that the edition of last year, which we recommended with the greatest confidence to our readers, has been put in the shade by the addition of about 200 pages of reading matter in the present volume, it will be readily understood that the book is as good value for money as it is possible to obtain. We may mention amongst the fresh matter included in the extra pages, a large section on the development of electrical engineering, some eighty pages having been devoted to alternating currents and electrical traction installations, with notes, data, and numerous illustrations. There are also new sections relating to machine tools, screw-cutting, &c., and some interesting notes on refuse destructor furnaces, and comparisons between various types of steam generators. Indeed, we may say with certainty that the possession and intelligent use of a pocket-book of this character would save our readers and ourselves an enormous amount of trouble. At least half the queries our correspondents shower into the editorial letter box are here answered in full, and we therefore urge model engineers everywhere to make a good start in the coming year with the purchase and continual use of this excellent book of reference.

THE PRACTICAL ENGINEER POCKET-BOOK FOR 1900. Manchester: Technical Publishing Company, Limited, 31, Whitworth Street. Price 1s. 6d. (Without diary, 1s. nett). Postage 2d.

This pocket-book has two special points to recommend it, in addition to the copiousness of its contents—it is printed on thin paper, which makes it very portable, and its contents have been arranged in a simple and logical manner, which is a very advantageous addition to a well-arranged index. Electrical science finds a goodly section devoted to it—dynamoes and motors, transformers, secondary batteries, lamps, and similar matters being represented, and some good practical notes given on traction and electric welding. As every engineer should, have some clear and reliable knowledge of all the branches of

his profession, he could not do better than have at hand a source of information such as this book for constant reference and use. We should strongly recommend the edition with diary on squared paper for all who are likely to need a note book and diary, and if this is taken into account it will be seen what excellent value is given in this practical pocket-book.

ELECTRICITY AND MAGNETISM. By W. PERREN MAYCOCK, M.I.E.E. London: Whittaker & Co., 2, White Hart Street, Paternoster Square. Price 2s. 6d. Postage 3d.

There are some novel features in this elementary book, most of which are commendable. There is, for example, a very good list of apparatus, with prices attached; which will be handy to the teacher who uses this text-book in his classes. A full set of questions is appended to each of the three parts into which the book is divided, and ruled pages are provided at the end for notes to be inserted by the student. On the other hand we cannot quite get over a dislike to the author's system of "electrical shorthand." It is probably due, in part at least, to prejudice, but we much prefer to see "—ly" printed "negatively." Mr. W. Perren Maycock is the author of a very simple exposition of the theory of static electricity, and this is embodied in the book in clear and convincing language. Science teachers will do well to see this text-book, with a view to adopting it for class use.

THE LOCOMOTIVE OF TO-DAY. London: The Locomotive Publishing Company, Limited, 9, South Place, Finsbury, E.C. Price 2s. 6d. Cloth. Postage 3d.

So many of our readers are interested in obtaining reliable information as to the actual constructional details of modern locomotives, that we feel sure this volume will have an extensive sale. It is not only essentially practical in the nature of its contents, but is well arranged and full of instructive and excellently produced illustrations. Altogether, there are thirty-seven full-page drawings of locomotive details, and sixteen full-page plates showing photographs of notable modern locomotives, including the new ten wheel four-coupled bogie express, L. and Y. Ry.; the eight-coupled L. & N.W. Ry. compound mineral engine; the new American-built Mogul Midland Ry. engines; and the N.E. Ry. six-coupled bogie passenger engine. The detail drawings all show examples of up-to-date practice, and in many instances are accompanied by a scale, so that they may be used as working drawings by the model locomotive builder who wishes to reproduce the real thing as closely as possible. The literary matter is divided into four sections, dealing with The Boiler; The Engine; The Framing and Wheels; and The Tender and Brakes; and the various details comprised in each section are described in a very clear and comprehensive fashion, the portion on valve gears, link-motions, and valve-setting being particularly instructive reading. The book contains close on 200 pages, is well printed, and neatly bound in cloth.

USEFUL ARTS AND HANDICRAFTS. Edited by H. SNOWDEN WARD, F.R.P.S. London: Dawbarn and Ward, Limited, 6, Farringdon Avenue, E.C.

The above title has been given to a new series of small handbooks which are to deal with a number of the "minor arts." One of the books is published every Thursday, price 6s., and each is complete in itself. With the aid of these hand-books, plus common sense and a few of the most ordinary tools, no one need have difficulty in beautifying his home or making very many useful or decorative articles. Our readers who feel interested in the series should write for a descriptive catalogue, sending a stamp for postage, to Messrs. Dawbarn & Ward, Ltd.

Model Railways.

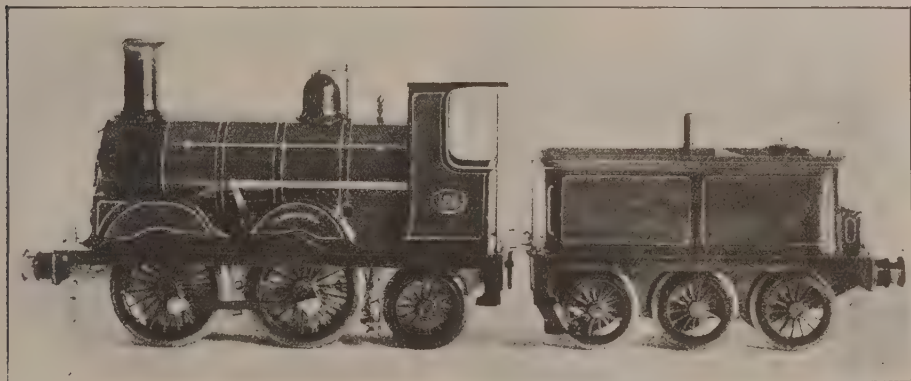
III.—A Miniature L.B. & S.C. Railway.

(Continued from page 236).

THE description of the permanent way having been fully dealt with in our previous article, we will now pass on to the subject of the rolling stock and motive power. As may be seen from the photographs in our last issue, the rolling stock is, for a model railway, rather extensive. It comprises three close-coupled block trains of three carriages each, one bogie-coach and main-line brake, two single carriages, one carriage truck, one horse-box, six trucks, one goods brake, and one motor-coach. The engines include two of Mr. Stroudley's "B" class, "Croydon" and "Arundel"; one "G" class, "Newhaven"; three "D" class tank engines—"Dulwich," "Ovingdean," and "Ditchling"; one terrier "A" class, "Surrey"; one "E" class, "Montpellier"; and one "D bogie" class, "Crystal Palace." With the exception of the clockwork engines,

which it has to fulfil are taken into account. Indeed, we think there are but few amateur, or even professional model makers who would have solved this problem in so neat and yet so efficient a fashion as did Dr. Bradbury Winter. Dr. Winter has been kind enough to send us some notes on this portion of his work, and we think we cannot do better than reproduce, in his own words, the story of the evolution of these clockwork wonders. He writes as follows:—

"The requirements for the two locomotives were that they should be exactly similar in size and design to those already in use, but were to be fitted with clockwork which should enable them to draw an ordinary train the length of the railway, and still have energy left for shunting. The clockwork was to be out of sight, and in no way to disfigure the engines. It was also necessary that they should be able to go equally well forwards or backwards, and that there should be an easy means of stopping them when running; the starting and reversing being performed by the same levers in the cab as in a real engine. A slow speed was also required, so that the trains should run safely through the complicated junctions and sharp



MODEL CLOCKWORK LOCOMOTIVE.—MR. STROUDLEY'S "B" CLASS "ARUNDEL."

the above all have gunmetal wheels and metal frames, with cardboard superstructures, while the ordinary rolling stock, which are built for lightness, have celluloid or boxwood wheels, with steel frames and cardboard bodies. It is worthy of special remark that the proper head-boards or lights are affixed to each engine before starting it on a journey.

Before the advent of the clockwork engines, the motive power was obtained by the action of gravity. The platform or base-board on which the permanent way is laid down, had a trunnion on each side at the centre, and these trunnions rested in bearings fixed on a trestle support. The whole railway could thus be slightly tilted one way or the other, and thus impart the necessary motion to the trains. It is obvious, however, that by this arrangement trains could only run in one direction at a time, whereas, under the present conditions, two, or even three trains, "up" and "down," are frequently run at the same time, and this considerably increases the effectiveness of the combinations which it is possible to obtain.

The mechanism of the clockwork locomotives is of a particularly ingenious character, and its merit is more apparent when the stringent and peculiar conditions

curves, and the speed was to be as nearly as possible constant, regardless of the length of the train or steepness of the incline.

"A passenger coach similar to those used on the railway was also to be made and fitted with clockwork, fulfilling the same conditions as regards uniformity of speed, reversing, and stopping, but the extra space available was to be utilised by making it capable of travelling twice as far as the locomotives. When a train is being run with one of the old engines which have no motive power, this clockwork coach is attached to the train, pushing the engine in front of it, though to all appearances it is the engine which is pulling the train.

"The chief difficulty was the small size of the engines, the gauge being only $1\frac{1}{4}$ ins., and the length of the frames of the express engine being $4\frac{1}{2}$ ins., and those of the tank engine 5 ins.; the frames were made of sheet steel 1-16th in. thick and $\frac{1}{4}$ in. apart. The various spindles and cogwheels were pivoted between the frames, as in a clock, and could, of course, be taken out by simply removing one frame; but in the case of the six carrying wheels (which are external to the frames in these engines, being models of the Brighton Company), their

axles could not simply revolve in holes in the frames, as they could then never be removed without taking the wheels off the axles—a very undesirable process. To overcome this difficulty, slits $\frac{1}{4}$ in. wide, with bevelled edges, were cut in the frames, and pieces of steel like axle boxes, fitting the slits, were riveted to a strip of thin saw-plate, the three axle boxes sliding into the three slits together, and forming a split bearing, the holes for the axles being drilled half in the frame and half in the sliding piece, as shown in the illustration (Fig. 1).

"The barrel containing the mainspring was made of steel, bored out of the solid; by using steel instead of brass the walls could be very thin, and a greater internal space procured. In designing the engines the first consideration was to get in as large a spring barrel as possible, and then fit in the rest of the mechanism in the space left. In each engine, the spring barrel was placed in the firebox. In the case of the tank engine, where there was more space at the side, the cogs were fixed at one end of the barrel in the usual way; but in the express engine, in order to use as large a barrel as possible, the cogs were fixed so as to come in the centre of the boiler. This was

spindle portion which works in the frames being screwed into the thick part on which the spring is wound. When it is necessary to insert a new spring this spring portion is unscrewed by simply turning the winding key backwards, and the arbor having then no connection with the frames,

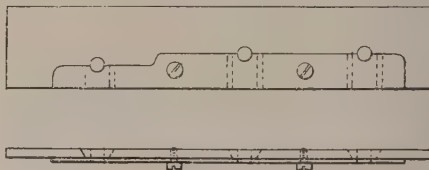
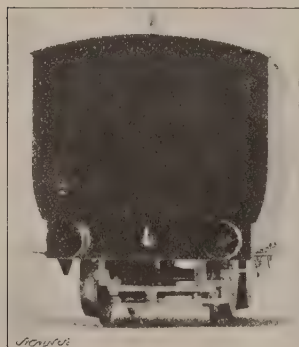
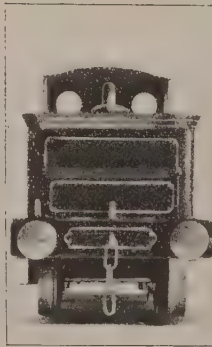


FIG. 1.

simply drops out with the barrel. In order to have no projection from the frames, and to keep the winding hole as small as possible, a square hole was punched in the arbor into which the key fitted, instead of having a projecting square for the key to fit over.



END VIEW OF MOTOR COACH.



END VIEW OF "ARUNDEL."



END VIEW OF "DITCHLING."

done by chucking the cogwheel in a recess in a piece of brass in the lathe, and then boring it out to within 1-64th in. of the bottoms of the teeth; this very delicate ring was then slid over the barrel, which was turned to fit, and when in its proper position, carefully soldered all round. In barrels which have no stopwork to prevent overwinding, the springs are very liable to break at the eye in their outer ends, where they are slipped over a projecting rivet inside the barrel. To prevent this, a slot of a length equal to half the breadth of the spring was cut in the barrel, and the end of the spring was tapered and turned round to catch in this, forming a kind of hinge.

"Fig. 3 shows the usual method and the sudden bend which takes place at A each time it is fully wound. Fig. 2 shows the slot method. This has answered admirably, and no spring has as yet broken at this point. The springs are, however, worked at a high tension, in order to get as much power as possible, the arbors or spindles on which they are wound being rather small, and in consequence their life is not as long as in a clock, the break usually occurring two or three inches from the inner end. As this accident is unavoidable, it was necessary to provide an easy means of putting in a fresh spring.

"The arbor was therefore made in two pieces, the

"Since the barrel occupied the firebox, and the driving wheel axle curtailed the adjacent space, it seemed that the only way to fit in the next cogwheel was to mount it on a hollow spindle, which should work on the driving axle; and to multiply the speed a larger wheel was also fixed on the same hollow spindle. This larger wheel geared with a small wheel mounted on a pivot half way between the driving and leading axles, and on this pivot was also a large wheel gearing with small wheels on each of these two axles; the two axles were thus each driven directly by the clockwork independently of the outside coupling bars. This arrangement, however, required modifying, for when made as just described, although all the wheels worked perfectly freely when worked from the driving or leading wheels, yet when worked from the barrel they instantly bound fast, and the greater the force applied the tighter did the wheels jam. It was a long time before the cause of this was ascertained, all kinds of ideas being thought of before the right one, and the lesson to be learned from it is certainly useful.

"Of course, in the train of wheels, those near the barrel have much more power on them than those more remote; therefore the wheels on the hollow spindle, working on the driving axle, had great power on them, which implies

considerable thrust and friction on the bearings, the whole of which was thrown on to the driving axle (the last wheel in the train, and, therefore, with comparatively small power). With such thrust and friction on this highly-gear'd spindle, it could not revolve, and the greater the power applied the tighter was this axle pressed against its bearings. The cause having been discovered, the remedy was simple; instead of having the driving axle revolving in holes in the frames, with the hollow spindle working on it, the hole in the frame nearest the cog-wheel (which received the greater part of the thrust) was enlarged and the hollow spindle lengthened so as to pass

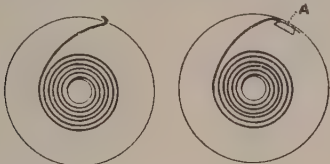


FIG. 2.

FIG. 3.

through it; the powerful thrust on the hollow spindle was thus thrown on the bearing in the frame, while the driving axle revolving inside it and not touching the frame was perfectly free.

"Mention has just been made of a spindle midway between the driving and leading axles. This spindle carried the reversing gear, which consisted of two steel discs about $\frac{1}{2}$ in. apart and joined together by a central tube which slides over the spindle, revolving freely on it. The discs supported short spindles with small cogwheels, arranged so that the motion was conveyed through two wheels when the discs were in one position, and through one wheel when in another position.

"If as shown in the diagram (Fig. 4) the gearing passes from D through A to E, E will revolve in the same direction as D, but if by turning the disc through a

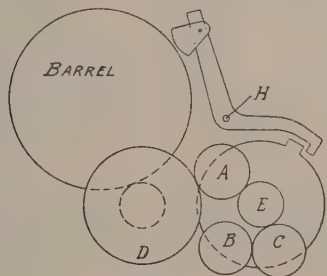


FIG. 4.

small arc A is disengaged from D, and B thrown in, the motion will pass from D through B and C to E, and E will then revolve in the opposite direction to D. The disc was connected to the reversing lever in the cab by a rod.

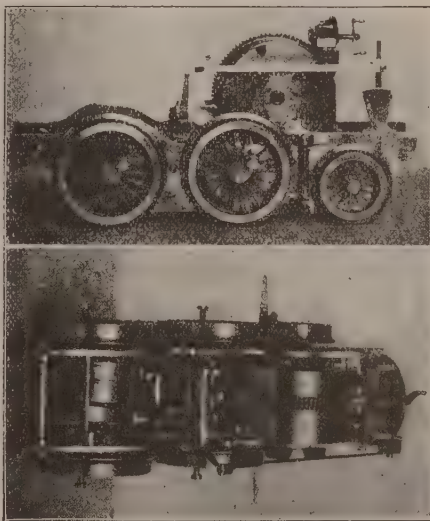
"It will be seen that when the disc is being moved there is a moment when A and B are both disengaged from D, and then if the main spring were wound up, it would fly down. To prevent this a projecting tooth was made on the disc, and a lever pivoted at H was pressed on the disc by a light spring. On the other side of the pivot this lever carried a segment of a cogwheel fixed so that it could only move through a very small distance.

"Before the disc could be moved, the lever must be

raised to clear the tooth, and this caused the segment of the cog at the other end of the lever to engage with the barrel and prevent running down until, the disc being turned, the lever dropped on the other side of the tooth. The lever was raised to clear the tooth by a cam, worked by the same rod that moved the disc, the double movement being, of course, performed by only a single movement of the reversing lever in the cab.

"A governor for keeping the speed uniform was worked by gearing from the last wheel in the train. The available space was very small—only sufficient for a diameter of $\frac{3}{8}$ in., and a length of $\frac{3}{4}$ in., and the governor had to be very powerful and sensitive. Four different arrangements were made, each improving on the last, and then a satisfactory mechanism was arrived at.

"The main principles are shown in the accompanying sketch (Fig. 5). A is a thin steel disc, which revolves with the central spindle of the governor, but is free to slide along it. B is also a steel disc, but fixed firmly to the spindle, and has



SIDE VIEW AND PLAN OF MECHANISM OF THE
"ARUNDEL."

two slots in it to allow the two levers, C and C₁, to hinge outwards. These two levers are pivoted at one end to a cross piece fixed to the spindle (not shown). At their free ends they carry brass weights. The discs and levers (but not the weights) are enclosed in a cylindrical steel box, which is held so as not to revolve, but it can slide along the spindle.

"When the spindle revolves the weights fly out, and the short arms of the levers hit against the thin disc A, and press it against the end of the box. Since the disc is revolving and the box is held, there is friction between the two. The pressure of the disc against the box causes the box to slide along the spindle until its other end presses against the disc B, and here, again, friction is caused; and, of course, the higher the speed the greater the pressure and friction. The levers were connected together in the usual way, and compressed a spring on the spindle in flying out. The box was made in two pieces,

like a pill-box, only the lid screwed on, and adjustment of speed was obtained by screwing up or unscrewing the lid; for the further the levers had to fly out before they compressed the discs against the box, the more of their energy was absorbed in the spring, and the less was available for pressure on the discs. In all the other experimental governors there was only one disc, which was pressed against the frame, and, therefore, all the counter resistance was wasted. Considering the fact that this governor revolves at a comparatively slow speed (about twice as fast as the driving wheels), and that its greatest diameter when the weights are fully expanded is less than that of a shilling, it is extraordinary what perfect control it keeps on the engines. In the tank engine it is placed under the cab; but in the express there was no room in that position, and it had to be fixed on a hollow spindle on the leading axle, revolving twice as quickly as that axle. The governor is usually adjusted for a slow speed for safety round curves, the engines running at the rate of one foot per one second, which corresponds to 33 miles per hour for a real engine.

"The arrangement for stopping the engines consisted of two brass plungers passing through holes in the frames, one on each side, and telescoping into each other in the middle. A spring tended to force them apart against the inner faces of a pair of wheels, but they were ordinarily kept off by a catch. When, however, a

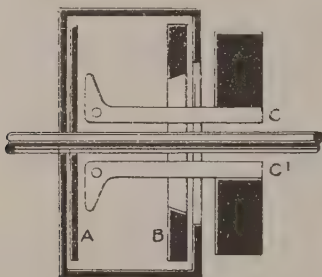


FIG. 5.

small lever underneath the foot-plate was touched, the catch released the plungers and they acted as brakes on the wheels. On turning the regulator handle in the cab the plungers were again drawn off, and the catch flew up and secured them. This mechanism was placed in the smokebox of the tank engine, a rod passing through the boiler from the regulator handle, and the plungers acted on the leading wheels. In the express engine the plungers acted on the driving wheels, and the mechanism was under the cab. The levers under the foot-plate could be touched either by spring clips which could be attached to the overhanging edge of the platform and only projected 3-32nds in., being, therefore, unnoticeable; or if a stop was required where there was no platform, a brass casting was laid against the line and acted in the same way, its weight being sufficient to release the plungers.

"The carrying wheels were cast in gunmetal as simple solid discs; these were faced up in the lathe to a template, the spokes were marked out, holes drilled in the intervals, and finished by filing. There were eighteen spokes in the leading and driving wheels, and fourteen in the trailing. No springs were used, but to make the engines keep on the road safely the treads were more bevelled than in a real one, so that under ordinary circumstances the flange is hardly needed; this is 3-32nds in.

high, and is, of course, required on crossings and curves.

"The outside casing, boiler, cab, foot-plates, &c., were made chiefly of thin tinned plate, except those parts which were to be left bright, which were made of steel, brass, or copper, as in the real engine. The casing fitted down over the frames just a sliding fit, and could be removed in a few seconds without having to release any screws. There is nothing special to say about the tender, except that it was made as light as possible, so as not to impede the engine in ascending inclines; the tender wheels were the same as the trailing wheels of the engine, $\frac{3}{4}$ in. diameter on the treads, or the size of a sixpence, and had fourteen spokes.

"The express engine was the most powerful, and could haul twenty-six coaches on the level. If taxed beyond its powers the coupled wheels would slip on the line like a real engine, and would continue to work at the regular speed until the spring was run down.

"Exactly the same methods were employed in the clockwork coach, though, of course, the parts were differently arranged to suit the shape. It had a much larger spring barrel, and the extra power thus obtained was converted by higher gearing into a longer range than in the engines, the length of its run with one winding being 60 feet.

"The casing, as in the engines, simply lifted off, without any fixing; there were three small holes in the roof, into which the key could be inserted. The central hole was for starting the coach; by pressing the key into this hole the brake was released, and the wheels were free to revolve. The other two holes were for reversing; if the key were pressed into the hole nearest one end of the coach, it would move in that direction; and if pressed into the other hole it would move in the corresponding direction, this being effected by the key pressing on one or the other side of the reversing disc, and so causing it to move through the required arc, as described for the engines.

"The engines each weighed less than 1 lb., the coach slightly over; the exact weights were:

Tank engine	...	...	15½ ozs.
Express engine, without tender	...	...	14¾ ozs.
Tender	...	...	4½ ozs.
Coach	...	...	1 lb. 3¾ ozs.

The weight of a train of twenty-six coaches (not clockwork), excluding the engine, was 5½ lbs.; the express engine could, therefore, draw a load on the level equal to six times its own weight, which is equivalent to an engine weighing 50 tons drawing a train of 300 tons—a very fair load."

The reader has only to examine the various illustrations to this article to understand that the building and equipping of this railway has been the work of years and not of months. As a matter of fact, it was some ten years ago that it was first planned out, and during that space of time it has undergone much development and improvement. Finality has by no means yet been reached, and what it may be like in another ten years is, perhaps, difficult to foretell. However, in taking our present leave of this fascinating model, we will express the hope that Dr. Hovenden and his brother will permit us to keep our readers posted up in the various additions and alterations upon which they may decide, for we feel sure that no one can read the description of the existing railway without feeling the liveliest interest in its future development. Meanwhile, we owe our best thanks to the "Directors" and to the "Locomotive Superintendent" of this truly "model" line for their courtesy and kindly assistance in enabling us to present so instructive and interesting an account of their handiwork to the model engineering world.

Model Yachting Notes.

[The Editor will be glad if the Secretaries of Model Yacht Clubs will keep him advised of all doings of interest suitable for insertion in this column.]

WE have had several requests lately for the lines of a really fast model yacht from readers who are anxious to build a boat during the winter months. We are pleased to be able to announce, in this connection, that we have prevailed upon Mr. Paxton, whose name will be familiar to most model yachtsmen, to give us the lines of one of his latest models, and these we propose to reproduce in our next issue. As Commodore of one of the crack London clubs, and as the result of many years designing, building and sailing of model yachts of all classes, Mr. Paxton is in the front rank of experts in this subject, and we can promise our readers something of special merit.

The hon. sec. of the yacht club of H.M.S. *Cuirassoa* writes from Devonport under date of November 3rd:—
“We are waiting a stiff gale to blow out, to make a start for the Mediterranean, calling at Gibraltar, Cartagena, and Port Mahon, and returning to England about December 20th. I can assure you that if we discover any model yachtsists at these places, we will sail matches with them—i.e., if their particular measurement rule does not make it too difficult for us to do so. We have a new 20-rater, two new 10-raters, and two 5-raters now being built on board.”

The question of model yacht measurement still provides matter for energetic discussion, as will be seen from our correspondence column. The *pros* and *cons* appear to have been well threshed out by this time, and it would seem that there is really room for two distinct standard measurement rules—one for open-water boats and one for pond and lake boats. We think that if any definite decision is to be arrived at it should be done quickly, so that model yachtsmen may know on what basis they should build their next season's craft. It is, of course, from the point of view of inter-club racing that a uniform measurement rule is most desirable, and we should therefore welcome a definite pronouncement from all club committees as to what steps they are prepared to take to bring this result about. The Newsham Park M.Y.C. have already agreed to fall in line. What do the other clubs say?

The East Hull M.Y.C. has again succeeded in capturing the local challenge shield, having lately defeated the Kingston Club in a keen contest for this trophy. Each club was represented by seven boats, and the first three places were secured by Mr. John Bell's *Wonder* (7 points), Mr. J. McColl's *Jock* (6 points), and Mr. E. Driffield's *Minerva* (6 points), in the order named. These were all East Hull boats. The fourth prize was secured by a Kingston boat—Mr. Mills' *Annie*—with 5 points. Mr. Roberts, of the Kingston Club, acted as starter, and Mr. Grandin, of East Hull, as judge. Several of the races had a very close finish.

The recent annual dinner of the South Shields M.Y.C. was a very successful affair, and, judging from the speeches made, there is plenty of life in this old-established club. During the past season they have arranged fifteen races, and over thirty prizes have been competed for. Five cups belonging to the club were raced for and won, and a new cup has been presented to be

raced for next season. The cupholders from last year were all defeated, and in one instance a new member, sailing his first race, carried off the trophy—a splendid silver cup. The membership of the club is increasing, and a very satisfactory coming season is anticipated. A pleasing feature of the proceedings at the dinner was the presentation to Mr. R. A. Terviel, the hon. sec., of a handsome marble timepiece in recognition of his services.

Model yachting in South Shields dates back to the early sixties, the pilots and the shipwrights of the locality forming the competing parties. In 1866 a club was formed, and in 1867 a regatta was held. In 1872 a cup was offered for competition, and was won by Mr. Wm. Swinburn. Mr. Kyle succeeded in winning it during the following year, and again in 1875 when it became his own property. One curious condition on which this cup was held was that the owner had to be prepared to defend his title not oftener than once a month. The present club was inaugurated on October 4th, 1886.

Correspondence.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication. Communications should be written on one side of the paper only.]

Model Yacht Measurement.

TO THE EDITOR OF *The Model Engineer*.

SIR,—The model sailor, who would not like to see one common formula in use for measuring model yachts, is probably not to be found; hence the great interest shown in the discussion on the subject of measurement now going on in your valuable paper.

“Vested interests” are, I fear, the chief obstacle that we have to overcome before we can arrive at a formula which will be generally accepted as satisfactory, so many boats having been built in different parts of the country for the express purpose of being able to win under the particular rule in force, without any consideration as to whether they are otherwise of what yachtsmen would look upon as “a wholesome type of vessel,” many being mere racing machines and monstrosities.

It seems to me, therefore, that a common formula can only be brought about by degrees. As a means to this end, I look upon Mr. T. A. Bruce's suggestion for the establishment of a class in which length, beam, and sail area shall be limited, as a very good one, and I have no doubt that a sufficient number of enthusiasts would be found, who would not only build to such a class, but who would subscribe each his mite towards a challenge cup to be competed for by boats qualified to sail in the class.

In order to bring about the reform desired without unnecessarily injuring “vested interests,” I would not absolutely fix the dimensions, but say:—Length on L.W.L. shall not exceed × inches, Beam shall not exceed × inches, Sail Area shall not exceed × square inches, and I would go one step further and say Draft shall not exceed × inches! × being the number of inches to be decided on after discussion.

Mr. Bruce suggests 40 ins. L.W.L., 10 ins. beam, and 2000 sq. ins. sail area. No doubt an excellent boat could be built to these figures; but it seems to me that the draft would be excessive, or the boat could not carry the sail. I consider the draft excessive as soon as it exceeds the beam. And, to come back to our old

friends, "vested interests," I would suggest a L.W.L. of not over 38 ins., a beam of not over 12 ins., a sail area of not over 2000 sq. ins., and a draft of not over 10 ins., for this reason, that I believe there is a large fleet of excellent boats in existence which now sail as 10-raters (apart from sail area) which could show excellent sport with very trifling alterations of rig or ballast, and which would be able to qualify under the above figures, and which would do so for the sake of the sport and the possible kudos of winning the challenge cup when provided. Owners of these 10-raters, built under the L. & S.A. Rule, would, with difficulty, be persuaded to build boats 40 ins. by 10 ins., I think, and so the reform cart would stop. Limiting the draft would do away with skimming dishes, which are useless unless the wind happens to be quite steady and of just the right strength.

Several of the rules mentioned by your correspondents seem very good; but, personally, I am of opinion that model yachtsmen ought to follow the leading authority in the yachting world, and use whatever formula is, or may be, adopted by the Y.R.A. I do not overlook the difficulty (a very real one) of finding competent measurers amongst club members. As the Y.R.A. Rule, which taxes girth as well as length, both of which are difficult to measure accurately in modern boats, would require much time and patience, which measurers can rarely afford to give, I am therefore not prepared to say that the rule is the best possible for model yachtsmen. I object absolutely to the L.W.L. only being measured. It breeds only monstrosities. I think it a retrograde step to measure the L.O.A., for I take it for granted that we are all agreed that overhangs fore and aft are advantageous and in every way desirable with a given L.W.L. An excessive overhang either fore or aft is detrimental to the boat on account of windage, if for no other reason. Then why tax it? The overhangs are governed by the lines of the underwater body, and if the bow line and buttock are good, the boat with the biggest underwater body will have the shortest overhangs. It seems to me, therefore, that taxing the L.O.A. works in the wrong direction.

I like Mr. N. Smith's rule: $\frac{1}{3} \text{ L.W.L.} + \text{B} + \text{D}$, and I should like Captain Owen F. Gillett's $\frac{\text{L} + \text{B} + \text{D} + \sqrt{\text{SA}}}{3}$

if $\text{L} = \begin{cases} \text{Length of L.W.L.} \\ \text{instead of L.O.A.} \end{cases}$ very much indeed, but for simplicity, and considering all things (and amongst these *all things* "vested interests" play a very important part) I am still in favour of the $\frac{\text{LWL} \times \text{SA}}{6000}$ formula.

I think the suggestion made by Captain Lyon, president of H.M.S. "Curacao" M.Y.C. is excellent, and the proposed rule very good. The only apparent objection to the latter being, to my mind, the difficulty of measuring girth. I presume that, in order to prevent cheating the rule, girth would be measured in accordance with the Y.R.A. Rules? (Captain Lyon does not go very minutely into this matter.) If so, we may, I think, bid a long "good bye" to bulb fin boats; but I do not know that we need grieve much over that.—Yours, etc.
London, S.E. "CHRYSLAL."

TO THE EDITOR OF *The Model Engineer*.

SIR,—The suggestion of Captain Lyon to form a Model Y.R.A. meets with the unanimous support of the Newsham Park M.Y.C. We will willingly adopt any rule agreed upon. Our club supports the rule I proposed last month, as amended by Mr. Hancock, namely:—

$$\frac{1}{3} \text{ LWL} + \text{B} + \text{D}.$$

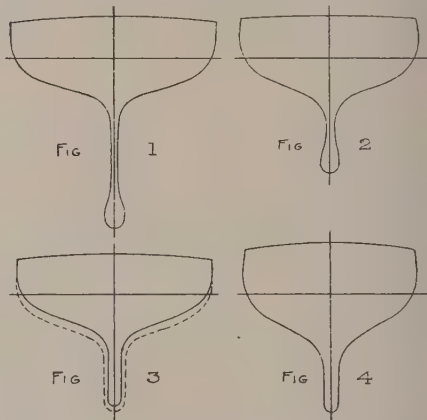
I think the average 10-tonner is $38 \times 8 \times 9$. It is

supposed by many that the 1730 Rule encourages a heavy boat, but this is not the opinion of our club. Our boats of this year are both lighter and faster than last year's boats, and weigh from 10 lbs. to 14 lbs. A moderate 10-rater is, I believe, about $38 \times 12\frac{1}{2} \times 11$, with a section like Fig. 1.

A 42-ft. linear rater would be about $37 \times 10\frac{1}{2} \times 7$, with a section about as full as Fig. 2.

The sail tax by this rule is very light, yet the boats built to it have but little displacement.

The Curacao Club suggests an improvement on the L. & S.A. Rule by taking $\frac{1}{2} \text{ L.W.L.} + \frac{1}{2} \text{ girth}$, instead of L.W.L. The obvious effect of this rule would be to increase length at the expense of girth, keeping the



sail small. We should probably have boats about $50 \times 11\frac{1}{2} \times 6\frac{1}{2}$, with small sails, and therefore small displacement (see Fig 3).

The rule we propose is

$$\frac{1}{3} \text{ LWL} + \text{B} + \text{D}$$

using Y.R.A. classes, namely, 30, 36, 42, 52, 65 ft. A 42-footer by this rule would average $40 \times 10\frac{1}{2} \times 7\frac{1}{2}$, with a very little more displacement than the Y.R.A. boat, owing to the absence of the small sail tax (see Fig. 4). This would allow moderate fin keels, and overhangs. I should give such a boat about 14 lbs. displacement. At the same time heavy keel boats would have a fair chance, just as they do under the 1730 Rule, but a sail tax would spoil this. We want a rule which will admit both types. Again, the making of light weather sails calls for an immense amount of ingenuity. The measuring of sails is a complex and unsatisfactory process.

Liverpool.

N. SMITH, N.M.Y.C.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I was pleased to see that "Audrey" was thought good enough for notice in the October issue, and Plymouth folks have also expressed their pleasure.

I thought Mr. Bruce's letter in same number, just the right and proper article to take a good lead towards the desired end—viz., one measurement for all clubs, and Mr. Hancock's letter this month is also well to the point, and I hope others will follow in the same strain. I do not feel prepared to do so, for the simple reason that I do not consider myself sufficiently experienced in any

class of models, other than Y.R.A. 6000 Rule, to offer practical suggestions, but I am firmly of opinion that there must be two distinct measurements as regards pond and open water models. The various rules are satisfactory to the clubs adopting them; but for satisfaction to all concerned, I think the more simple the measurements, the easier it will be to the club measurer. I had three years experience of measurements. Forty models to get through in a season, and in some cases the same boat measured several times to get within rating or brought up to rating, is no joke, particularly when one had to walk three miles to club to do so.—I am, Sir, yours faithfully,
 Queenstown. WILLIAM CUBBIN.

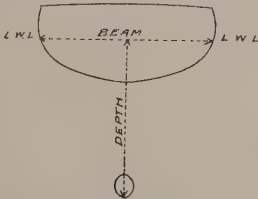
TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—In writing to express my appreciation of Captain Lyon's remarks which appeared in your last issue, I trust that other clubs will take up our President's suggestion and send on their proposed rule. After further thought I think the following is as near a perfect measurement rule as possible:—

$$\frac{\frac{3}{8} \text{ LWL} + \text{Depth} + \text{Beam} \times \text{SA}}{6000} = \text{Rating}$$

Depth measured from L.W.L. to keel at greatest depth.

Beam measured on L.W.L.—thus:—



Trusting this might bring us nearer to a solution of the problem.—Yours truly,
 H.M.S. Curaçoa. W. F. BEHENNA.

The Society of Model Engineers' Conversazione.

A Brilliant Success.

THE first Conversazione given by the Society of Model Engineers was held in the Library and Board Room of the Memorial Hall, Farringdon Street, E.C. on Saturday evening, November 11th, and proved a brilliant success. The members mustered in strong force, and, including visitors, the company assembled numbered nearly three hundred. Among those present were Mr. J. Macfarlane Gray, M.I.M.E. (late of the Board of Trade), Mr. Jas. Restler, M.I.C.E., Mr. Basil H. Joy, A.M.I.Mech.E., Mr. Walter T. Dunn, Mr. Geo. Harrison, M.I.M.E., Dr. Gerald Hovenden, Mr. Sydney Rentell (Editor of *Electricity*), Mr. H. Snowden Ward, F.R.P.S. (Editor of *The Photogram*), Mr. Chas. Hastings (Editor of *Hobbies*), Mr. F. Moore (Editor of *The Locomotive Magazine*), Mr. S. B. Shelton (*The Carriage Builders' Journal*), Mr. Thorpe, Mr. Melhuish, jun., Mr. Jas. C. Crebbin, Mr. A. M. H. Solomon, Mr. E. L. Pearce, Mr. W. J. Tennant, A.M.I.Mech.E., and the indefatigable hon. secretary of society, Mr. Herbert Sanderson. The guests, on arrival, were received by the Chairman and Mrs. Percival Marshall.

The rooms were tastefully decorated, and were lighted throughout by electric light, the general effect being con-

siderably enhanced by the presence of numerous handsome and superbly finished models. An excellent service of light refreshments added greatly to the comfort of the guests. The musical portion of the programme, under the direction of Mr. A. M. H. Solomon, was much appreciated, especially by the fairer section of the assembly, and included vocal and instrumental items very ably rendered by Miss Loebi, Miss Fisher, Miss K. L. Solomon, Miss Harding, Mrs. Lucas, Miss Grainger, Mr. Helmer, Mr. Harold Samuel, Mr. J. S. Physick, and Mr. Reginald Marshall. Mr. Stanley J. Harding, who sang a military song, appropriately appeared in the uniform of the Electrical Engineers Volunteer Corps and secured an encore. The concert was divided into two portions, and during the interval some selections were admirably rendered by Mr. W. M. Day's string band.

The scientific section of the entertainment comprised an original and instructive lantern lecture, entitled "The Light Side of Science," by Mr. W. J. Tennant; a demonstration of x-Rays by Mr. Harry W. Cox; and demonstrations of the latest types of Edison's phonographs, including the new concert phonograph, by the American Talking Machine Company. Messrs. Hobbies, Limited, showed a fret-cutting machine at work, and also some very attractive fretwork articles produced from their designs. Mr. Hildersley tested the electrical powers of endurance of many of the visitors with a shocking-coil, and Mr. J. C. Taylor showed some very fine pictorial lantern slides on the screen.

The models and apparatus on view, however, naturally formed the principal attraction, and the opinion was freely expressed by those competent to judge, that, apart from the South Kensington Museum, no finer collection of engineering models has been on view in London for many years past. Not only were the exhibits good in point of number, but also in the more important point of quality. Cylinders of compressed air were provided, from which connections to a number of models were made, and the latter were thus shown at work during a considerable portion of the evening. Some of the electrical exhibits, too, were connected up to the supply circuit, and shown in operation.

Messrs. C. A. Parsons & Co. exhibited two fine ship models, one showing a 35-knot torpedo-boat destroyer, and the other a 30-knot cross channel steamer, the motive power in each case being a Parson's steam turbine. The Thames Ironworks, Limited, contributed four handsome models of a battleship, a gunboat, a steam yacht, and a river steamer; and two well-made model steam launches were shown by Mr. G. Braine, and Mr. L. Ferriera respectively. Mr. J. Restler kindly lent a model steam fire engine made by Mr. Thomas Coates, and also a model manual fire engine, and a model G.N.R. locomotive.

We regret that pressure on our space precludes us from noticing all the models in detail, but the following list will show the comprehensive and interesting character of the exhibits:

Mr. W. Alcock—model of Midland Railway locomotive; Mr. H. S. Boorman—model steam pump; Mr. F. J. Burnham—model steam engine; Mr. J. C. Crebbin—model locomotives, Nos. 2 and 3, and photographs; the Crypto Works Company, Limited—small dynamos and motors; Mr. C. H. Eden—model steam hammer; the General Electric Company—electrical heating and cooking apparatus, motors, telephones, batteries, &c.; the Great Eastern Railway Company—model loco boiler, motion parts of loco, model of single wheel express engine No. 603, liquid fuel burners (Holden's patent), model of G.E.R. horse-box, "Eitherway" brake for waggon; waggon door balancing arrangement; Mr. W. Grassie—model field guns; Mr. H. Hildersley—slide rest and lathe head;

Drs. G. and A. C. Hovenden—model clockwork locomotives; Messrs. W. Horseman & Co.—small lathe, with wheel cutting attachment, and small tools; Mr. J. A. Levett—model railway carriages; Mr. R. J. Lowne—small atmospheric engines, locomotives, and other models; Messrs. Lucas & Davies—model engines; Messrs. Marriott & Cooper—free-wheel cycle and motor parts; Messrs. W. Martin & Co.—model locomotive parts, castings and drawings; the Model Supply Company—model American locomotive castings; Messrs. Merryweather & Sons—model steam fire engines, model fire escape, hand pump, “Chute” fire-escapes, etc.;



Mr. Percival Marshall—engineering photographs; Mr. Reginald Marshall—engineering photographs; Messrs. Melhuish, Sons & Co.—cases of engineers' tools; Mr. H. E. Morriss—model launch engine; Mr. F. Moore—locomotive photographs; Messrs. Nurse & Co.—lathe and engineers' tools; Mr. E. L. Pearce—model locomotive, and engineering drawings; the Pittler Lathe Company—model of “Pittler” lathe, and accessories; Mr. E. W. Payne—model engine and dynamo; Mr. A. M. H. Solomon—model locomotive and photographs; Mr. S. L. Solomon—model locomotive and track; Messrs. T. J. Syer and Co.—lathe, work-bench, and tools; Stevens' Model Dockyard—model engine parts and fittings; Mr. W. J. Taylor—model engine; Mr. J. C. Taylor—model steam hammer; Messrs. Thorpe & Salter—small gas engine and pump; Messrs. Whitney—model engines, &c.

The programme itself was produced in an original

and attractive fashion, and had a specially designed cover, a reduced *fac-simile* of which we reproduce herewith. The unqualified success and the extremely enjoyable character of the whole proceedings came as an agreeable surprise even to the members themselves, and we think the society is to be heartily congratulated on so satisfactory a commencement of its second year. It has amply proved the need for its existence, and we look to seeing the membership go ahead by leaps and bounds.

ANNUAL GENERAL MEETING.

The annual general meeting of the society took place on Tuesday, November 14th. A full account of the proceedings will appear in our next issue.

THE NEXT MEETING.

The next meeting of the society will take place on Monday, December 4th, at 7 o'clock, at the Memorial Hall, Farringdon Street, E.C., for which occasion several attractive exhibits have been promised. Mr. A. M. Bushell's paper on “Automatic Brakes” will be read at this meeting.

LIBRARY.

The library has been enriched by the following additions: “Compound Locomotive Engines,” presented by Mr. E. L. Pearce, and *Locomotive Magazine*, Vol. III., given by Mr. F. Moore.

PROVINCIAL BRANCHES.

BRADFORD.—The usual meeting of the Bradford branch of the Society of Model Engineers was held at the Coffee Tavern, Tyrell Street, on Monday, November 6th, 1899. From 7 to 8 o'clock the time was employed in an inspection of models supplied by the members. Mr. N. Firth showed a model vertical boiler made by himself. A visitor showed a set of patterns made from E. L. Pearce's too-watt dynamo. After this Mr. J. H. Lamb was called upon to lecture on Model Engine Building. The lecture commenced by a brief description of Watts' model, and then went on to the single-acting oscillating engine, also the double-acting oscillating engine, and finally the double acting slide-valve engine. The aforesaid engines were all supplied for the lecturer by the Model Supply Company, 4, Balfour Street. The next ordinary meeting will be held on December 4th at the Coffee Tavern, Tyrell Street, Bradford.—James H. Lamb, hon. secretary, Holly Bank, Thornbury, Bradford.

MANCHESTER AND SALFORD.—We are glad to be able to report that rapid progress is being made with the formation of a branch of the Society of Model Engineers for this district. A preliminary meeting was held on November 15th at Lockhart's Restaurant, Market Street, Manchester, when the rules were decided upon and the officers for the first session were elected. We hope to give fuller particulars of this branch in our next issue. Meanwhile, all model engineers and amateur electricians in the above locality who would like to join should communicate with Mr. S. Thompson, 27, Nelson Street, Broughton, Manchester.

SHEFFIELD.—The usual attendance at the Sheffield Society's monthly meeting was considerably augmented on the last occasion by many fresh members, who had been attracted by the excellent display of thirty-five models now on view at the Drill Hall, Sheffield. Mr. Veneer exhibited some splendid photographs of the society's stand. Mr. G. H. Rooke then read a paper on “The Construction of a Telephone,” illustrated by working drawings and an instrument constructed by the speaker. Mr. Shaw proposed a vote of thanks to the lecturer, who, in his reply, reminded the audience of their deep indebtedness to Mr. Shaw for his untiring efforts in furthering the interests of the society.

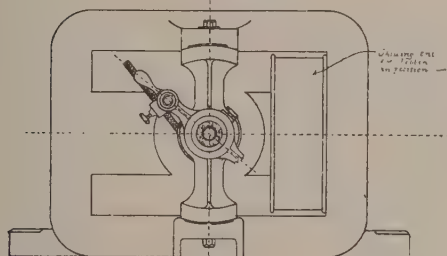
$\frac{1}{4}$ -h.p. "Avery Lahmeyer" Dynamo or Motor.

THE illustration shows a scale drawing of a $\frac{1}{4}$ -h.p. motor or dynamo, designed by A. H. Avery, of Fulmen Works, Tunbridge Wells. The design is peculiarly massive, and has the effect of very greatly reducing the amount of copper required in its construction to obtain a given output. The details of construction are clearly indicated in the diagram. The armature is

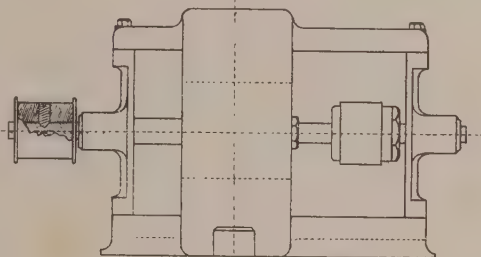
ference, *i.e.*, they are carried round four segments before being connected to the commutator in order to bring the brushes in a convenient position. Each of the F.M. bobbins consists of twenty-six layers of thirty-six turns each of No. 20 S.W.G. connected in shunt to the armature. It is convenient when the machine is intended for a motor to attach one end of the shunt coils to a third terminal separated from the brush leads. This enables a variable starting resistance to be employed, and obviates any chance of burning out the armature.

It is useful also for regulating the voltage when the machine is run as a dynamo. To develop $\frac{1}{4}$ h.p. this

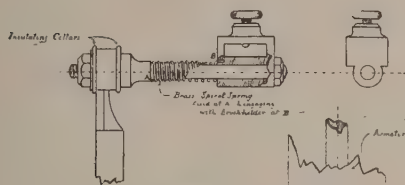
— Front Elevation —



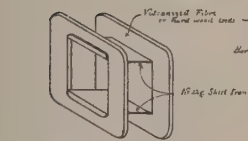
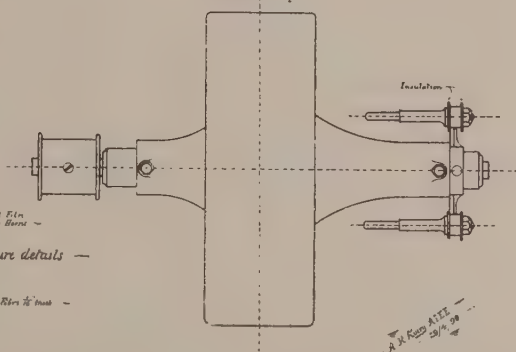
— Side Elevation —



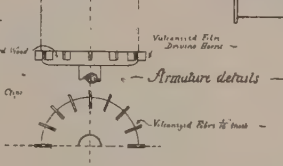
— Brush Gear —



— Plan (top) —



— FM Bobbin. Shewing method of —
— Building up —
(Haw vs. wind)



WORKING DRAWINGS OF "AVERY LAHMEYER" DYNAMO OR MOTOR.
Scale: 2 ins. = 1 foot.

built of plain drum type laminations mounted on a mild steel shaft, with thick vulcanised fibre heads, each slotted to receive driving horns of 1-16th in. sheet fibre, sixteen in number. The armature bore being machined out at the same time with the bearing seats, ensures perfect alignment of the bearings. The F.M. coils, it will be seen, are wound quite separately from the carcass, and afterwards slipped over the pole pieces and wedged in place. For a 50-volt machine the armature will be wound with 400 conductors in sixteen sections, each consisting of one layer of No. 19 S.W.G. overwound in the manner described in the next chapter of "A.B.C. Dynamo Design." The connections from armature to commutator segments are given a "pitch" of one quarter the circum-

ference, *i.e.*, they are carried round four segments before being connected to the commutator in order to bring the brushes in a convenient position. Each of the F.M. bobbins consists of twenty-six layers of thirty-six turns each of No. 20 S.W.G. connected in shunt to the armature. It is convenient when the machine is intended for a motor to attach one end of the shunt coils to a third terminal separated from the brush leads. This enables a variable starting resistance to be employed, and obviates any chance of burning out the armature.

It is useful also for regulating the voltage when the machine is run as a dynamo. To develop $\frac{1}{4}$ h.p. this motor requires 50 volts 7 amperes, and as a dynamo it will give 50 volts 5 amperes at 2,200 revolutions per minute, while it will safely work up to 65 volts 8 amperes (*i.e.*, 100 per cent. overload) for an hour at a time, without overheating or sparking.

A. H. Avery
1899

The Editor's Page.

WITH the present issue we complete the second volume of THE MODEL ENGINEER AND AMATEUR ELECTRICIAN, and if we may judge from the very frequent letters of congratulation which we receive from readers in all parts of the world, we believe we have carried out the promises made in our earlier numbers with some degree of success. We have had the pleasure of welcoming many recruits to the world of model engineering enthusiasts; indeed, so many fresh acquaintances have we made through these columns that our circulation is now exactly double that of our December issue last year. We feel sure that this encouraging increase is very largely due to the kindly efforts of our readers themselves in making the paper known to their friends, and we think this is an opportune moment for expressing our sincerest thanks to those who have helped us in so practical a fashion. We venture to hope that such useful influence will continue to be exerted, and with as good a result, so that this time next year we may again report a 100 per cent. increase in our sales.

One of the most interesting events of the past twelve months has been the marked success which has attended the formation of the Society of Model Engineers, and we are not paying this enterprising organisation too high a compliment when we say that its first conversazione, described at length elsewhere in this issue, was an affair of which a ten or even twenty-year old society might have well been proud. We expect great things from this society in the future, and those of our readers who can possibly attend its meetings will be acting in their own interests by becoming members. The provincial branches of the society at Bradford and Sheffield have, too, done excellent work, and are apparently on the high road to prosperity. An additional branch is now being formed in Manchester, and we hope to be able to report that this is in full working order by the time that we go to press with our next issue.

On December 1st our publishers will have ready a limited number of volumes of THE MODEL ENGINEER for 1899, neatly bound in cloth, price 3s. 6d. each. Readers who desire to obtain a copy should order from their agent at once, as the supply is likely to be very rapidly exhausted. Cloth binding cases for readers who wish to bind their own volumes may be obtained from THE MODEL ENGINEER office, post-free 1s. 3d. Our publishers also supply cloth reading cases, to hold twelve copies, at the same price.

The last day for sending in designs for our model locomotive prize competition is November 30th—i.e., five days after publication of this issue. Intending competitors should bear this date in mind.

It is a source of satisfaction to us to note the extent to

which our Postal Query Department is utilised by our readers, though we must confess that occasionally the number of queries we receive in a week is more than we can promptly deal with. However, in all cases we do our best, and we are glad to know that we are enabled to be of considerable help to our readers in this way. It should be borne in mind, that in common fairness to ourselves, there is a limit to the extent of the information which we can reasonably be expected to give. We sometimes get questions put to us which are really well within the province of a professional consulting engineer, whose charges for the information or advice would doubtless considerably astonish the innocent querist who looks to get the same assistance from us in return for a stamped addressed envelope. Another type of correspondent who adds a wrinkle to the editorial brow is he who asks us to send per return complete working drawings for a scale model of the latest — Ry. express locomotive! Also his cousin—it must be a relation of some kind—who tells us he is about to build a model locomotive, but is not quite sure whether he would like to adopt a Great Northern, a North Western, or a Midland design; will we kindly send him full particulars, with dimensioned sketches, of the various types of engines used on above railways, so that he may make a choice? We do not like to be asked questions out of mere curiosity, nor do we care to answer questions outside the legitimate scope of our journal; but we are always pleased to give what assistance we can through this department to readers who are really and truly wanting a reasonable amount of advice or information.

That our replies to queries are appreciated we have reason to know, as witness the following, which is a sample of the acknowledgments of the utility of our services which we frequently receive. The letter comes from "J. W. T.", of Upper Tooting, who writes: "The recipe you gave me for a dry battery (Query No. 1,537) has turned out splendidly. The battery is used on a medical coil, about which you also advised me, and it works for ten or fifteen minutes at a time without showing signs of weakness. I do not think any man could stand the full strength of the coil, no one so far being able to stand half the shock. I have fitted battery and coil in a case, and it looks and works far better than I dreamed of."

While on the subject of queries and replies, there is one matter to which we should like to call attention. It is that all communications containing anything of the nature of a letter must, according to Post Office rules, bear a penny stamp. We occasionally get letters—for the query department especially—bearing a halfpenny stamp but with the envelope left unsealed; the sender apparently being under the impression that so long as the envelope is not closed up the letter will go at the halfpenny rate. This is not the case, and for the privilege of receiving these underpaid epistles the Post Office makes us pay the usual fine of double the deficiency. Will those whom this paragraph concerns kindly make a

note of this fact, and in future pay heed to the proverb—"When in doubt, use a penny stamp"?

Readers who are desirous of information as to the training required for the engineering profession and the prospect of suitable subsequent employment will be interested in the articles on this subject which, under the heading of "How to Become an Engineer," have appeared in Nos. 1 and 2 of Messrs. Geo. Newnes, Ltd.'s new paper, *The Money-Maker*. The price of the paper is one penny, and it is obtainable at all newsagents.

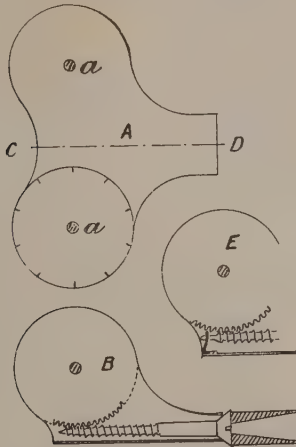
Practical Letters from Our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume if desired, but the full name and address of the sender should invariably be attached, though not necessarily intended for publication.]

A Cheap Speedometer.

TO THE EDITOR OF *The Model Engineer*.

SIR,—Amateurs often wish to test the speed of engines, etc., which run too quickly to be counted by merely letting the crank web touch the hand as it revolves.



The speedometer which I have just finished is very simple to construct, and will register high speeds.

I first of all got a strong cogwheel $2\frac{1}{2}$ ins. diameter with fifty teeth, then I got an ordinary wood screw nail of the same pitch, on to the head of which I soldered a piece of brass tube $1\frac{1}{2}$ ins. long, with a hole tapering from $\frac{5}{8}$ in. to $\frac{1}{4}$ in. Next I cut a piece of stout tin into the shape of A, which shape I found by means of a paper template, and bored two holes $\frac{5}{8}$ in. diameter in the centres of the circles, which holes were to receive the spindle of the cogwheel. I laid the screw-nail in position along the centre line C D, and bent up the tin, putting the cogwheel into its place/also. On turning the screw-nail it (the wheel) went round quite smoothly one revolution for each fifty times the screw made. I made a paper disc of the diameter of the tin disc, and divided it into ten equal

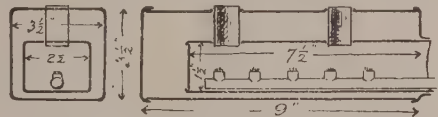
sections, and glued it on to the outside. I then took a piece of wire and soldered it on to the spindle on the same side as the paper disc was on, and the speedometer was complete. To use it, press the tapered tube over the shaft, etc., which you wish to test, and count the number of times which the pointer revolves in a minute.

Instead of allowing the screw to revolve loosely in the tin frame, a bearing might be made for the point, as shown at E. This consists simply of a small piece of tin drilled to take the end of screw, which should be filed round and true, the tin bearing being soldered in place when everything was set in correct position. The drawing B shows the general arrangement of the speedometer.

Boilers for Model Torpedo Boats.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—With reference to Query No. 1,141 (Nov.) might I give "T. J. P." a few hints on his model torpedo boat, as I have just constructed one myself? I should advise him to make the boat 4 ft. long, as he will find it



very difficult to get the good-sized boiler in a smaller boat. I should also advise him to have a slipper-slide instead of a connecting-rod, although it adds a little more friction to the boat, yet it keeps the weight down. I found the water-tube boiler, although it gets steam up very quickly, uses the water up almost at once, so that you need a force pump either attached to the main shaft of the engine or a separate engine to drive it; this takes up a lot of space. I have brazed together a boiler, as in the sketch I am sending, and tested it up to 70 lbs. on the square inch, and it gets steam up in a very short time; it also keeps the weight down in the boat. I can thoroughly recommend it, having made and used it myself. I hope these remarks will be of help to "T. J. P." If he would like to write to me about my boat, will you kindly forward my address to him? I hope to send you a description of my boat when fitted up; at present, the guns, etc., have to be finished.—Yours truly,
Cambridge. W. W. S.

Demagnetisation of Watches.

TO THE EDITOR OF *The Model Engineer*.

SIR,—I have read of many ways of demagnetising watches, but have noticed that they mostly require apparatus not always available for use of amateurs, such as powerful electro-magnets or high currents. The following simple method might be acceptable to your readers.

Procure a small horseshoe magnet (a twopenny one will do). Pass a piece of cotton round its neutral line, and tie the ends to any convenient point at which the system can be suspended. Now twist the magnet round a good number of times, so that it revolves rapidly on withdrawing the hand. While thus revolving, place the watch beneath its poles with its case open, the watch being as near to the poles as is possible without touching. After being in this position a few seconds, slowly withdraw vertically downwards. The magnet should revolve at the same rate throughout the operation.

The watch on which I tried this method used to lose five minutes a day through its being magnetised, but now keeps perfect time. The operation of demagnetising it occupied less than three minutes in all.—Yours truly,
Balham. J. B. F.

Queries and Replies.

[Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on separate slips on one side of the paper only, and the sender's name should be inscribed on the back. (2) A stamped addressed envelope should invariably be enclosed. (3) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the reply can be forwarded. (4) All queries should be addressed to The Editor, THE MODEL ENGINEER, 6, FARRINGTON AVENUE, LONDON, E.C.]

The following are selected from the queries which have been replied to recently:—

[1506] **Wireless Telegraphy Installation.** W. G. D. (Birmingham) writes:—I am fitting up a small wireless telegraphy installation. Could you assist me by answering the following queries? (1) What size sparking coil would be required to work the distance (5 miles), the stations being quite visible to each other, and standing on opposite slopes of a valley? Would 2-in. spark do? (2) Particulars concerning the relay, especially the winding of same. (3) Height of poles from ground. (4) Must the discharge of coil take place from balls? If so, about what diameter would be required? (5) Method of "tuning" the coherer to coil. (6) If they are "tuned" in same room, will they remain in "tune" when transferred to their respective stations? (7) Rough sketch of connections. (8) A 2-in. spark would suffice for the distance, but for a good transmitter at the sending end with sky-rod 50 ft. in height, and a delicate relay and coherer at the receiving end, with sky-rod also 50 ft. in height. (2) The relay should have a very delicate swinging armature, and should be wound with about 2 ozs. No. 36 silk-covered copper wire. Each core of the electro-magnet should be about $1\frac{1}{2}$ ins. long, $\frac{3}{8}$ in. diam. (3) Skyrods 50 ft. high, the other sides of both transmitter balls and coherer being taken to earth by fairly stout copper wires. (4) The discharge must take place between three balls, one larger central, two laterals smaller, say 3 ins. or 2 ins. diameter respectively, and the inner and outer coatings of a small Leyden jar should be placed in parallel current with coil terminals and the smaller balls. (5) The coherer is put in tune with coil spark—first, by altering the length of the rods or wings both at transmitter and receiver's second, by altering the length of spark gaps between transmitter balls. (6) No; because as the distance increases so the wave decreases in intensity as it spreads itself over a larger space. Hence, both spark gap and length of wings must be increased. Begin at short distances with the smallest possible spark, say 1-16th in., and the shortest possible wings, say 1 ft. until you get a distinct signal at, say, 50 ft. distance, then gradually increase the spark gap. Note that as the length of wings and spark wings is required for a distance of say, 100 yards, this will give you a fair criterion of the length of spark and wings required at 5 miles. It may also be advisable at longer distances to increase the battery power on the coherer terminals. (7) A sketch of the connections will be found on page 125, June issue, MODEL ENGINEER, a Wimshurst machine being substituted for the coil.

[1514] **Wimshurst Machine** H. H. (Chorley, Lancs.) writes:—I have made a four-plate 20-in. Wimshurst machine and only get about 4-in. spark. The plates are varnished, and 20 sectors on each plate. The supports for prime conductors are four salad oil bottles, coated 2 ins. outside with tinfoil, and filled up 2 ins. inside with small shot. When working, a powerful spark occurs between the outside of jars and the neutralizing rods which are fixed in movable boxes inside of case of machine. The prime conductors are 2-in. brass tube plugged with wood. The $\frac{3}{8}$ -in. brass upright rods, from prime conductors to main balls, are enclosed in glass tubes, but the electricity seems to escape through the glass tube; it also escapes along the horizontal rods leading to discharging balls, although all brass work is smooth and well polished. Will you kindly tell me where I am wrong? Can you place me in communication with an electrician who would advise me by post (for payment) on the Wimshurst machine?

Your fault lies in the fact that your jars are not connected together below, as they should be to get long sparks from the prime conducting rods. Probably, also, there is much dissipation in the neutralizing rods, which seem to be too close to jars. Cover the brass rods leading to discharging balls, with indiarubber tubing; this will greatly diminish dissipation. Glass tubes rarely insulate well; give them several coats of shellac varnish, allowing the one to dry thoroughly before applying the next. Write to S. Botton, Electrician, Wallington, Surrey, who will willingly assist you.

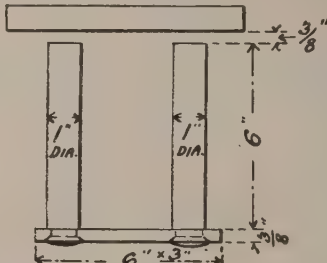
[1526] **Re Calculating Size of Boiler.** E. K. B. (Birmingham) writes:—Your answer 1215 (2), in the September number of THE MODEL ENGINEER, is one in which I am very much interested, but the following queries suggest themselves to enable me to complete my experiments:—(1) Does not the pressure at which the engine and boiler are worked affect the amount of steam used, or, in other words, presuming the engine uses 1000 ft. of steam per minute, calculated by your rule, will the same size boiler be required at 10 lbs. as at 20-lbs. pressure? (2) How will the heating surface be

reckoned in the case of externally heated boilers of a circular section?

(1) The same size boiler will answer, but more fuel would be burnt to maintain the higher pressure. (2) About one-third the circumference multiplied by the length of boiler would give the area of heating surface. If the boiler is supported on brickwork at the sides, the area of surface between the walls exposed to the fire is the available heating surface.

[1513] **Making an Electro-Magnet.** W. B. L. (Hull) writes:—I should be much obliged if you would kindly give me information on the following subject. I wish to work an electro-magnet on a 550-volt circuit. I think it would be best to use a resistance in series to reduce the voltage to what you think most suitable. I do not wish the magnet to be more than 5 or 6 ins. high, if possible. It also requires to have an attractive force of about 1 lbs. when the bar is $\frac{3}{8}$ in. from pole faces. Would you kindly give me a sketch to show the dimensions of magnet, also size of wire, quantity, and ohms resistance for magnet and resistance?

Let the cores of your electro-magnet be of best Swedish iron round bar, 6 ins. long, 1 in. diam., riveted or screwed into an



iron yoke, 3 ins. wide, 6 ins. long, $\frac{3}{8}$ in. thick. Having dressed the iron with tape, and well shelled the taping, wind each core with 2½ lbs. No. 36 silk-covered copper wire, 5 lbs. in all. Such a winding will probably require no resistance in circuit, as the resistance of the 26 wire will be equal to 4,400 ohms, so that even with 550 volts, only $\frac{1}{4}$ of an ampere will flow.

[1566] **(a) Wimshurst Machine; (b) Soldering.** L. L. (Hamstead) writes:—I am constructing a Wimshurst machine, and have got the two plates (sectorless) and the neutralising brushes in position, so that the collecting combs and discharging rods only are required to complete the machine. The plates are $\frac{1}{4}$ in. apart. Will you kindly tell me if I ought to get a spark to discharge across the plates, and also if the design is correct? On turning the handle and holding an excited ebonite rod near the plates I can get no effect. Are the plates too far apart, being between $\frac{1}{4}$ in. and 5-16ths in. apart, and could I get a spark without altering the distance they are apart? I have read that the collecting combs and other brass work have nothing to do with the action of the machine. Will you kindly tell me what is meant by hard soldering and how it is done? Also, what is meant by brazing, and how it is done?

Although it is possible to construct a sectorless plate that will work, it is practically impossible to get one to work without "starting" it by holding near it an electrified body, such as a stick of exciting sealing-wax or ebonite. But without the collecting combs you will, even under the very best circumstances, get little or no evidence of the charge being taken from the plates, as the plates cannot discharge themselves after leaving the brushes, they cease to accumulate. As far as we can judge from your description, we should say the machine is correctly designed; but as you do not mention the diameter of plates, we cannot say whether the distance ($\frac{1}{4}$ in. to 5-16ths in.) between the pair is too great or not. If the plates are anything between 15 ins. and 20 ins. in diameter, $\frac{1}{4}$ in. is a fair distance; but if the plates are smaller, the distance should not exceed $\frac{1}{4}$ in. at most. When you have finished your machine, rub the plates over with a cream of magnesia carbonate in water; allow them to dry thoroughly, and then rub off the white powder and this will remove any free sulphuric acid which may have been generated by the action of the air and of "fingering" on the ebonite of the plates, which sulphuric acid will totally prevent any machine from generating. By soldering is generally meant the process of uniting two metals by another metal or alloy with a low melting point, the operation being performed with a hot tool called a soldering iron. According to the nature and composition of the solder employed, it is hard or soft. Soft solder consists of one part tin and two parts lead. Hard solder consists of two parts tin and one antimony, or one tin, four copper, three zinc. The latter is almost too hard for ordinary solder, and is more suitable for brazing process. In this method the articles to be brazed are heated until the melting point of the jointing alloy is reached. Brazing alloys are usually a form of soft brass, the hardest consisting of three parts copper to one of zinc. With any of the above the correct flux is essential to good work.

Amateurs' Supplies.

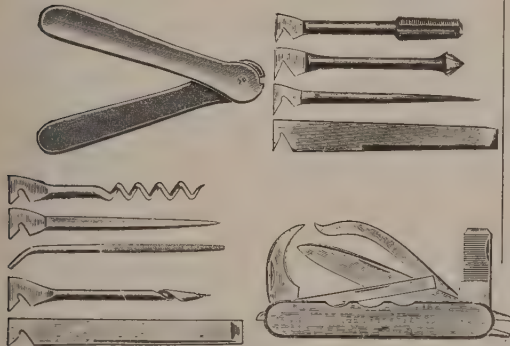
[The Editor will be pleased to receive for review under this heading, samples and particulars of new tools, apparatus, and materials for amateur use.]

Model Liquid Fuel Burners.

Mr. Geo. Goodman, of East Hayes, Bath, has been enterprising enough to get out patterns for the liquid fuel burners for model locomotives, as described in our October issue, and to supply rough-gun-metal castings at 3d. per set. The finished burner he supplies for 1s., and this we consider a particularly low figure in view of the excellent workmanship in the sample before us. We hear that these burners are selling well. Mr. Goodman has also sent us a full-size photograph of a stylish model steam hammer, made up from a set of his castings. These photographs may be had post free for 7d.

A Pocket Combination Tool.

That there is a growing demand for a really good pocket combination tool there can be no doubt, and we illustrate a new and very comprehensive form below. This is called the "Electron" combination tool, and we are able to state, after an inspection of the article, that it is a very highly-finished and ingenious piece of mechanism indeed. The illustrations will serve to give an idea of its general uses, the starting point being, of course, the homely



pocket-knife. This in itself carries some half-dozen tools, including a file and pair of pliers, and the handle is divided up into a convenient rule. The knife is carried in a neat leather case, which also encloses a number of other tools. These are used in conjunction with the knife just described, being inserted in a special slot when required for use. They include such useful items as a countersink, Bradawl, gas tap, wire pliers, gimlet, corkscrew, and so forth. The "Electron" Tool is sold by Messrs. Oswell & Strachan, 37, Lime Street, London, E.C.

A £20 Prize Competition.

The British Modelling and Electrical Co., of Macclesfield, have decided to offer prizes to the value of £20, to the strongest readers of this paper, for the best models made up from sets of model engine or electrical castings supplied by them. The competition is divided into classes for readers above and below the age of sixteen, and also into steam and electrical sections so as to enable readers to enter the particular section for which they are best suited. Full particulars of the competition will be sent to every applicant for the Company's new list. This catalogue is well illustrated, a good proportion of the blocks being actual reproductions of photographs. It is needless to remark that these give the purchaser a very much better idea of the appearance of the finished article than an ordinary "side elevation" drawing, and there is consequently less liability of buying "a pig in a poke," and a correspondingly better feeling between the firm and its customers. One excellent illustration is a photograph of a smart model gas-engine, which, to judge by the published testimonials, works at least as well as it looks. Another speciality is an electro-motor, in various sizes, for model launch propulsion, and we believe this little machine has been well received on all hands. A good feature is the set of printed instructions, properly illustrated, which the company issue with any set of parts, and this cannot fail to be a useful guide, especially to those whose knowledge of workshop practice is strictly limited. The catalogue should find a place on every model engineer's catalogue shelf, and we feel sure it will be often in requisition. The list will be sent to any reader on receipt of two penny stamps.

Catalogues Received.

The Universal Electric Supply Co., 47, Crosscliffe Street, Moss Side, Manchester.—Amateur electricians will be well advised in getting the sixth edition of the Universal Electric Supply Co.'s list, and keeping it by them for future reference. There is a fund of information as to the lowest prices for electrical goods of every description, and some excellent examples of new and improved apparatus to be found in its pages. Although so great a variety of electrical materials is listed, no pretence is made to completeness, for the simple reason that such completeness is almost an impossibility. However, the reader is invited to write the firm for any electrical part not included in the catalogue, and he is assured that it will be forthcoming. It is perhaps useless to run over the contents, as they are so varied, but we may remark that all the smaller items, which an amateur often has so much difficulty in procuring—such as insulating materials, telephone parts, lampholders, induction coil sundries, &c.—are all quoted. An excellent index, good printing, and convenient size, together make this a handy and useful catalogue, which all readers can obtain free by mentioning this journal.

The Model Supply Co., Balfour Street, Bradford.—This firm is well to the front with the new price list of models for the 1900 season, which covers about as much ground as could reasonably be expected. We note that the vexed question of charging for the catalogue has been met with a simple and perfectly fair device, the principle of which is that every list sent out is given a special number, which the customer is to quote when giving a first order to the amount of 5s. or over. The price of the catalogue, 4d., post free, will then be remitted from the customer's order. All ordinary types of model engines and dynamos are listed, as well as castings and parts. Many of these castings can be had in a special aluminium alloy, which is very much lighter than brass, whilst being hard, strong, and capable of taking a good finish. The special feature of the catalogue is, however, one which will strongly commend itself to MODEL ENGINEER readers. This consists of castings, forgings, etc., and finished parts of models which have from time to time been described in these pages. As a consequence, this part of the Model Supply Co.'s business is absolutely unique, and purchasers can be assured of having not only good working models of the most correct design, but also of possessing machines or apparatus quite out of the beaten track. Several improvements have been made even in this direction, and we note that Mr. Spicer's well-known $\frac{1}{2}$ -h.p. engine is being produced in a double-cylinder pattern in addition to the original type, and that dummy cast springs are being provided for the goods wagon, which was described in "No. 1," for those who want to reduce cost and trouble to a minimum.

T. W. Suter, 10, Highweek Road, South Tottenham, London, N.—An illustrated price list of a variety of electrical goods and scientific and mechanical novelties, including accumulators, dynamos, motors, castings, lamps, hot-air, gas, and steam engines, reaches us from this firm, and the articles quoted appear to be up to standard and reasonable in price. Readers on the look-out for novelties should send a halfpenny stamp for this list, in which they will find much to interest them.

Ward & Goldstone, York Street Electric Works, Chorlton-on-Medlock, Manchester.—Trade readers will find this well-printed list of wires and cables for all kinds of electrical work of much interest. Every variety of electric light and power cables, telephone and lamp flexibles, insulating materials, &c., is listed, and the catalogue will be sent post free to the trade, with discounts marked. A neat list of incandescent lamps will also be found of use.

W. Horsemann & Co., 72, Clerkenwell Road, London, E.C.—Two very useful catalogues (which will be sent free to readers of THE MODEL ENGINEER on receipt of the postage, 6d.) are issued by this firm of watch and clock tool makers. The first is a price list of the "Triumph" watchmakers' lathes and other specialties, including vices, metal saws, blow-lamps, movable shop-window "attractions," drills, screw-plates, &c. The second is a catalogue of "Standard Graphic" tools, lathes and sundries. In the latter are included calipers, files, chucks, screws, polishing lathes and materials, gauges, and so on, prices being given against each. Both lists are fully illustrated, and would be useful for reference.

F. & H. Shaw, Ltd., Helden Bridge.—The latest from Messrs. Shaw are four new pages for their catalogue, dealing with lathes and lathe castings. The latter consist of beds (straight and gap), standards, driving-wheels and spindles, cones, prices being quoted for machining on a desired part. Complete drilling machines and geared and ungeared bench lathes are also illustrated. All these goods are of a uniform high quality, and are sure to give satisfaction.

S. Holmes & Co., Albion Works, Jacob Street, Bradford.—The lathe catalogue of this firm of machinists to hand gives particulars of a varied assortment of lathe castings and sundries. A couple of photographs which accompany the list give a very good idea of the finished lathes. The chief feature of interest is the very reasonable price of the castings, a complete set of bench lathe castings being supplied at 5s. The complete machine tools are also low in price, and have a good workmanlike appearance. The catalogue will be sent post free for three d. stamps.

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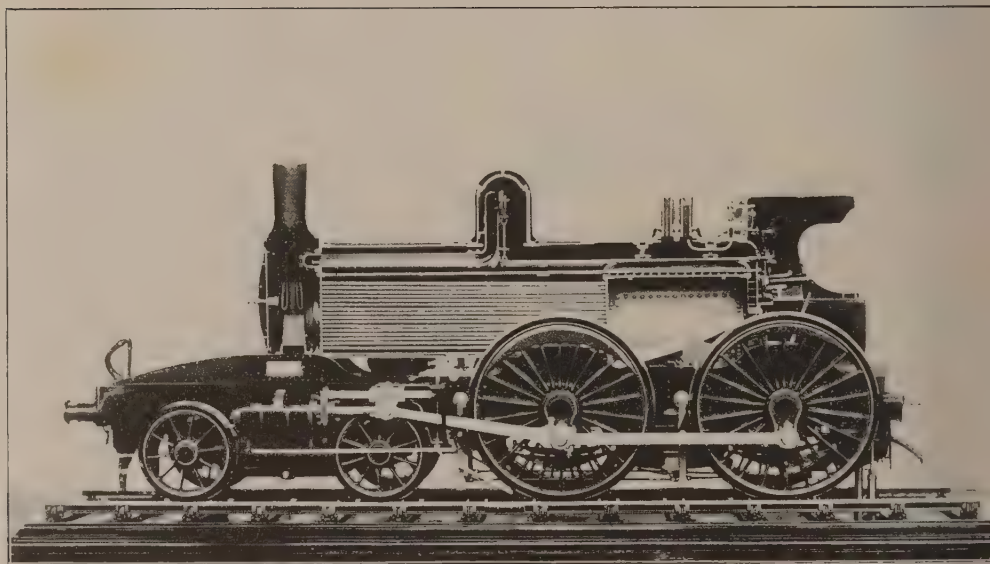
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